NOAA's National Weather Service Warm Season Spotter Course

Robert Haynes

July 16, 2021

Welcome!

Presentation Layout

- What is Skywarn? What does it mean for us?
- Overview of the National Weather Service in Burlington
- Overview of thunderstorm science and forecasting
- Storm types and convective warnings
- Safety and reporting severe weather

What is Skywarn?

- National network of volunteer weather spotters
- Reports many forms of significant or severe weather
- Trained by the NWS
- Roots in Amateur Radio

Who can be a Spotter?

- Amateur Radio Operators (SKYWARN)
- Emergency Management Officials
- Firefighters
- Law Enforcement Officials
- Rescue Workers and EMTs
- Media
- Researchers
- Students
- General Public
- Storm Chasers
- COOP/CoCoRaHS

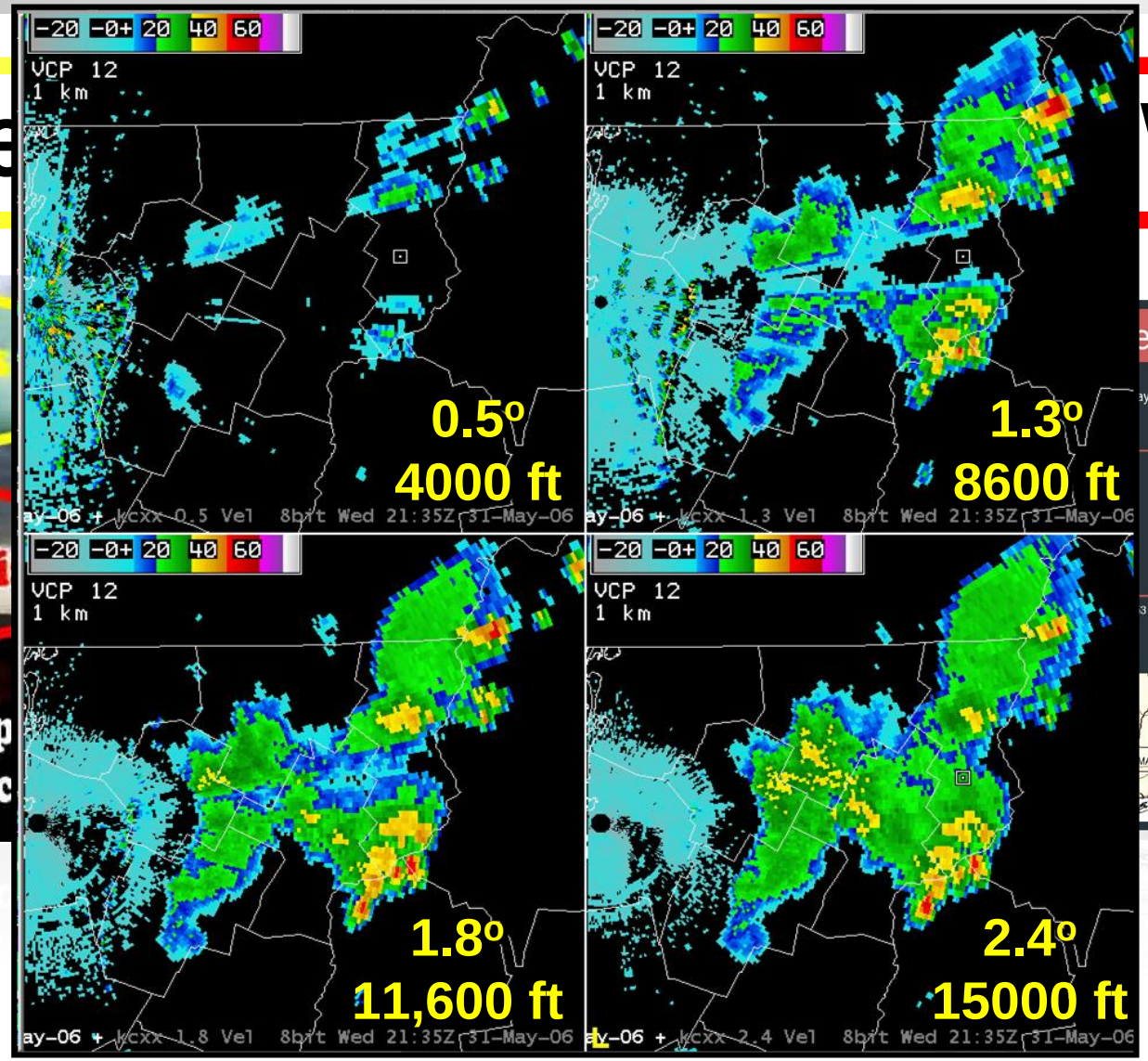
How to become a Spotter?

- ✓ There are no membership fees – It is completely free.
- ✓ We only ask that you are trained by a forecaster from the National Weather Service through any of the following:
  - ✓ *Through an in-person Spotter Talk or Presentation.*
  - ✓ *Through a virtual course – like the one you're participating in now.*
  - ✓ *Through a COMET/MetEd Course - https://www.meted.ucar.edu/training_course.php?id=23*
- ✓ If you move, we encourage you to contact the region's local National Weather Service.
- ✓ Upon completion, we ask for a physical location (latitude/longitude or address) and a contact number you commonly use. We may contact you if we notice a storm moving near your area! (But you can let us know if that is not preferred.)

Why do we need spotters?

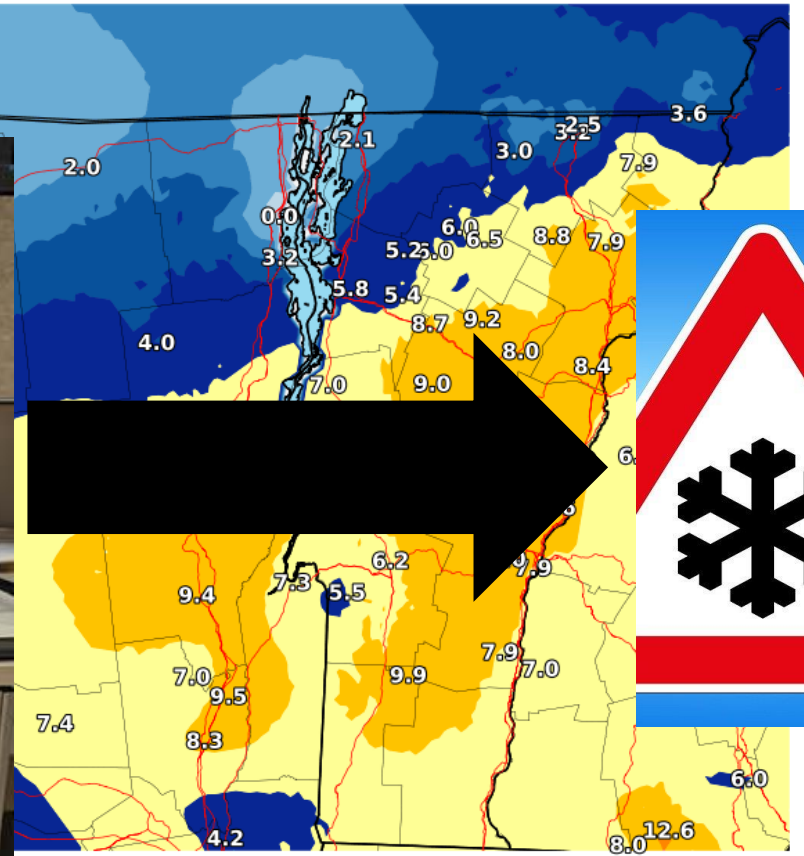
Observe

Warning



Why do we need spotters?

March 23, 2020 – Heavy Snow



National Weather Service
Burlington, VT
03/24/2020 10:54 AM EDT

Follow Us:
weather.gov/Burlington

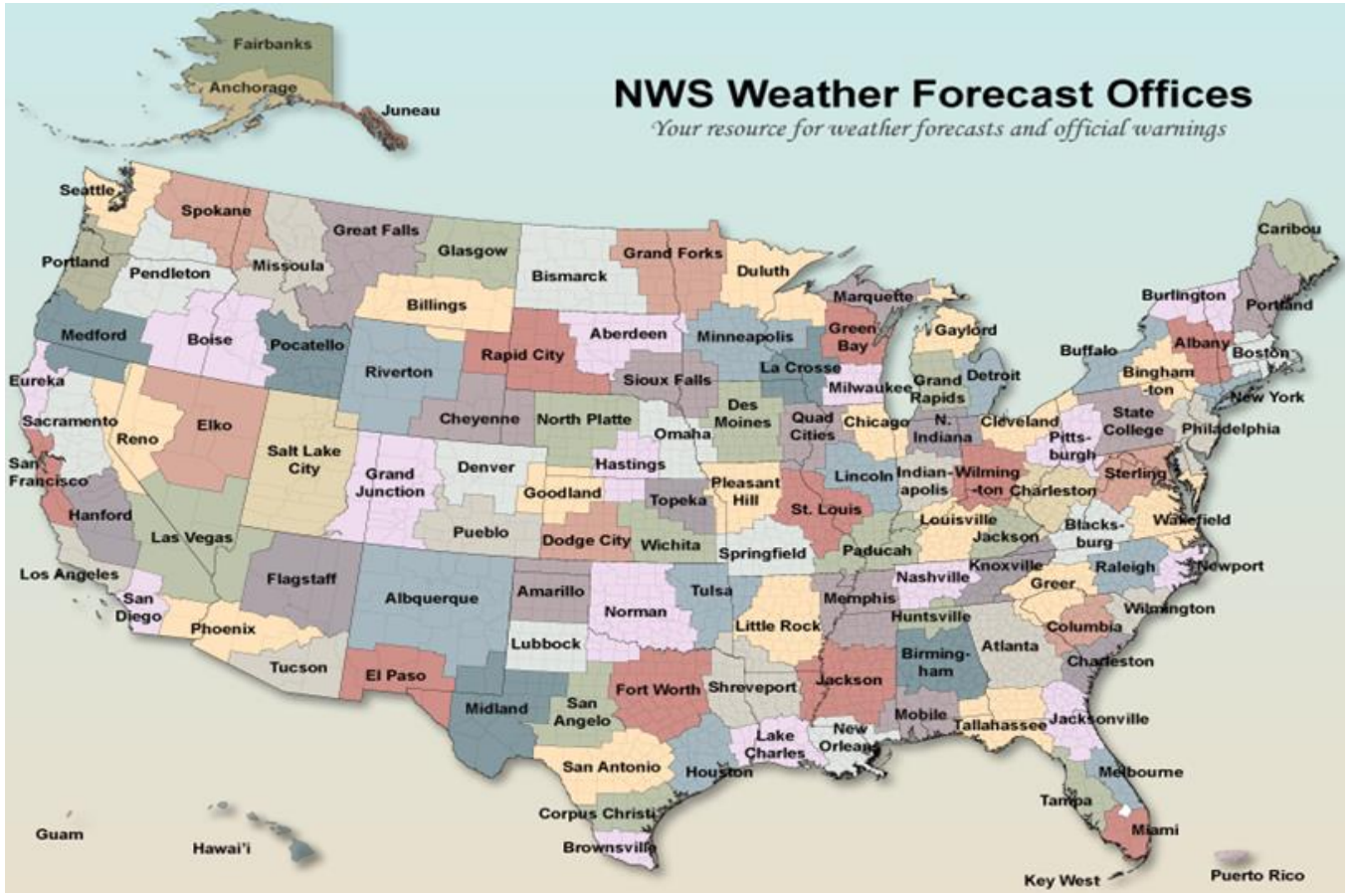
What is the National Weather Service?

NWS Mission

Provide weather, water, and climate data, forecasts and warnings for the protection of life and property and enhancement of the national economy.

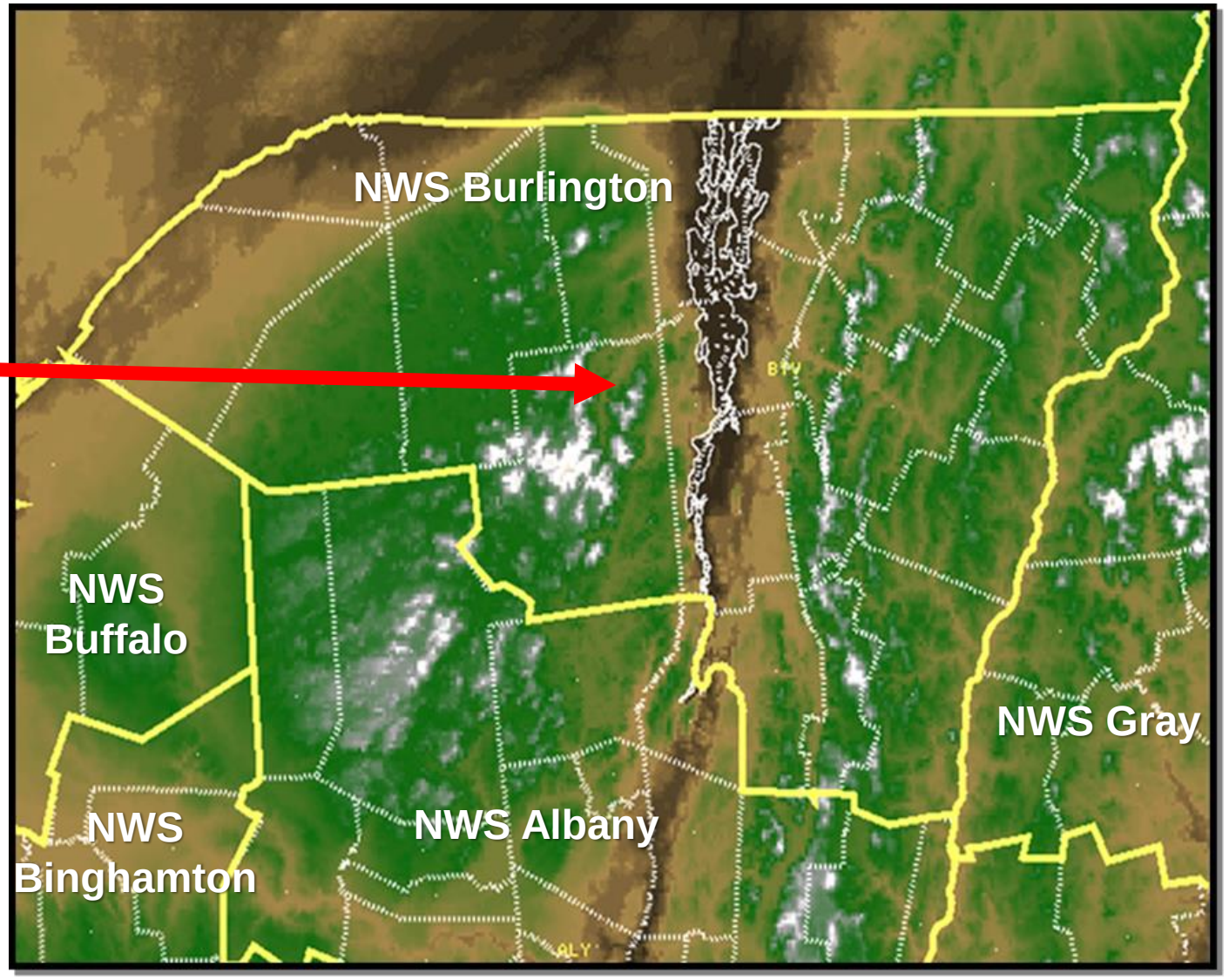
NWS Vision

A Weather-Ready Nation: Society is prepared for and responds to weather, water, and climate-dependent events.

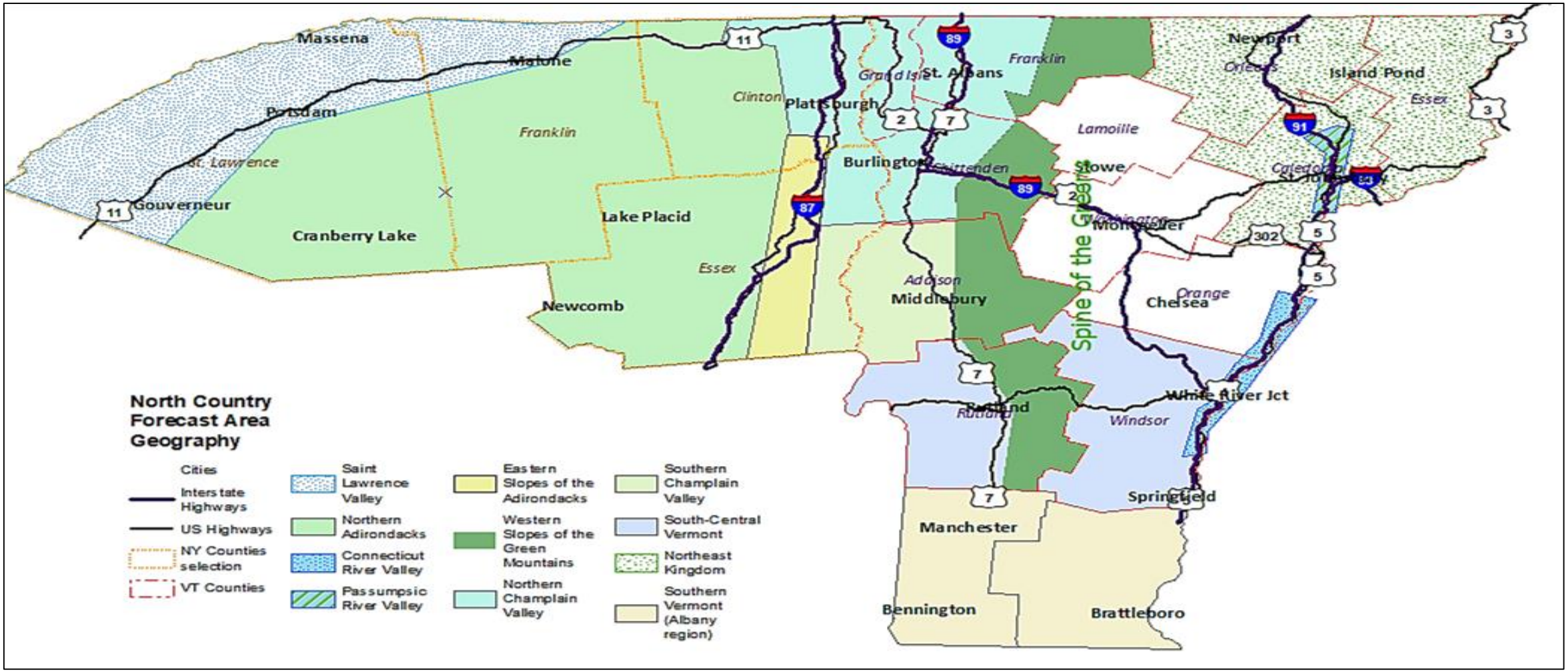


Where Do We Service?

- We service all of Vermont, except Bennington and Windham Counties and the 4 northernmost counties of New York.



Our Area of Responsibility



Overview of the National Weather Service in Burlington

- Branch of NOAA that focuses on the northernmost counties of New York state and all Vermont (except Bennington and Windham Counties – NWS Albany)
  - *Provide forecast and warning services for this region*
- Staffed 24/7
- More than just forecast, we research weather and climate in our local area to help better serve our local region.
- Coordinate volunteer observers for our region
- Collaborate with academia on research

Are there any questions?

- About Skywarn?
- About the National Weather Service in general?
- Anything else that comes to mind?

Awareness
Communication
Escape routes
Safety zones

Your Safety is ALWAYS #1

SEVERE WEATHER

HAZARDS

TORNADO
Take shelter immediately in a sturdy structure

LARGE HAIL
Move indoors away from windows

SEVERE WIND
Move indoors away from windows

FLOODING
Avoid rising creeks and water covered roads

LIGHTNING
Move indoors if you hear thunder

Over 280 fatalities occur each year in the U.S. from thunderstorm related hazards.

weather.gov/safety

Don't underestimate the power of water!

6 inches of fast-moving water can knock over and carry away an adult.

12 inches of fast-moving water can carry away a small car.

18-24 inches of fast-moving water can carry away most large SUVs, vans and trucks.

Lightning Safety

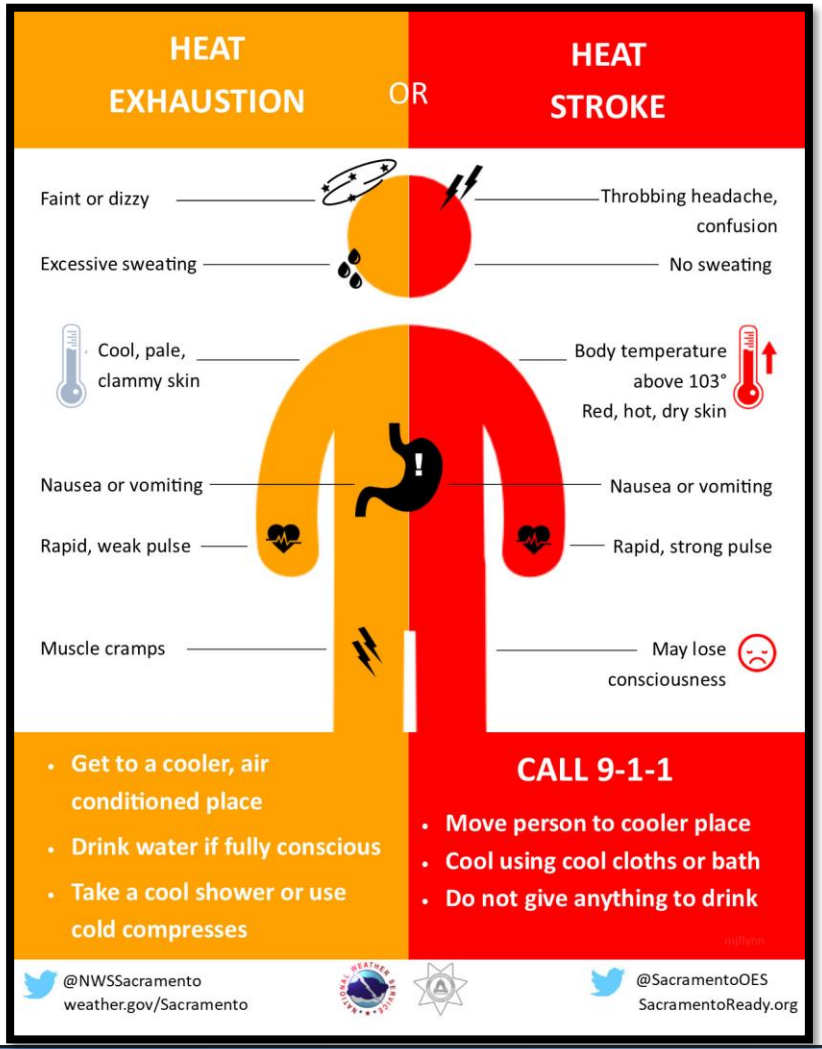
From Flash to Thunder:

Count 5 seconds =
1 mile away!

Lightning Safety **30/30 rule**

Heat Safety

Heat Index combines measure of temperature and humidity



Heat Advisories issued for heat index of 95 or higher for at least 2 hrs.

Excessive Heat Warnings for heat index of or higher than 105 for at least 2 hrs.

- ✓ Slow Down
- ✓ Dress Appropriately
- ✓ Drink Plenty of Water
- ✓ Air Conditioning
- ✓ Sun Safety

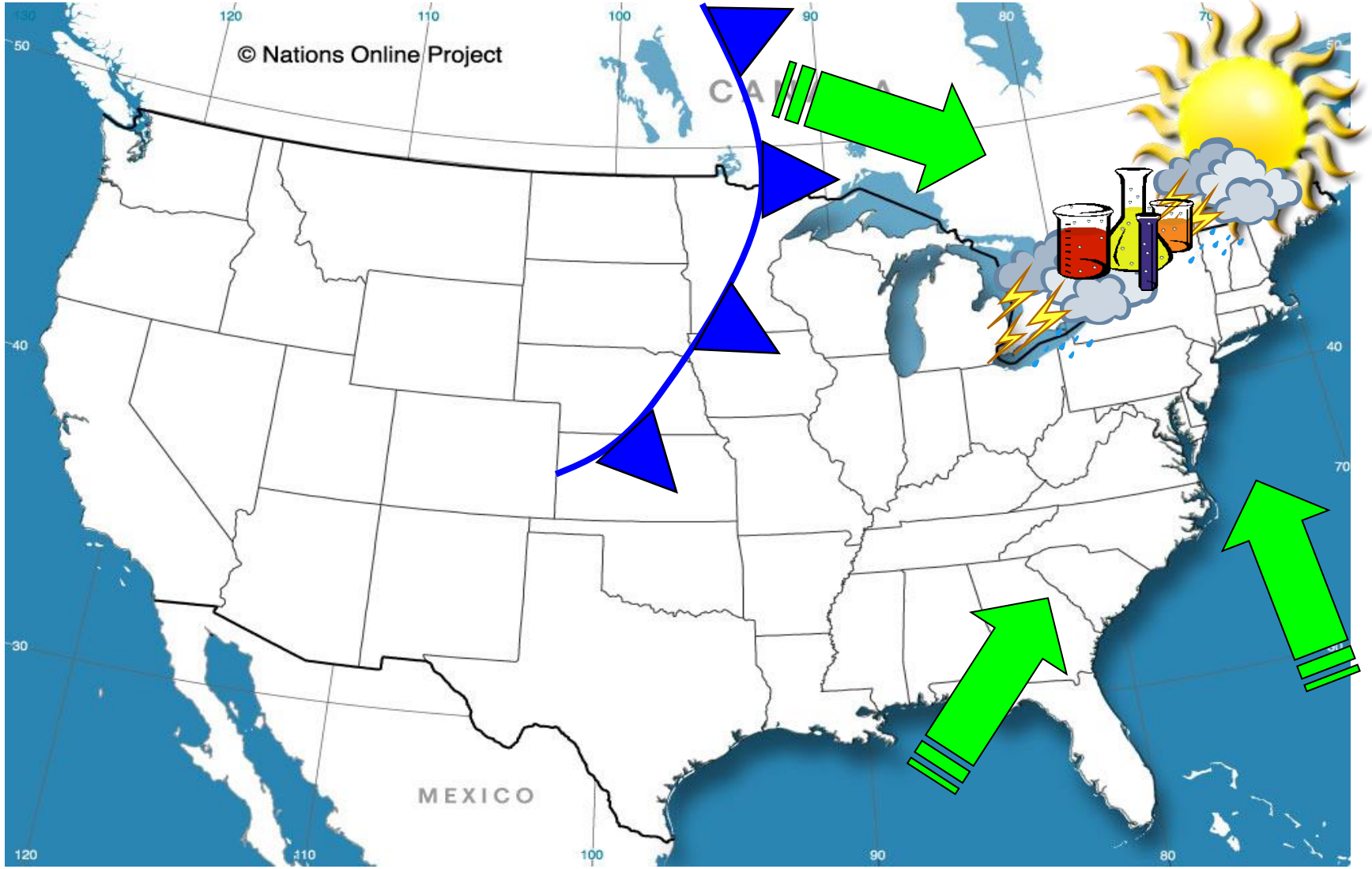
Overview of Thunderstorm Science and Forecasting

At the minimum, thunderstorms need **3** things

1. Moisture
2. Atmospheric Instability
3. Forcing mechanism (less needed in summer)
4. *To become severe, storms need something extra*

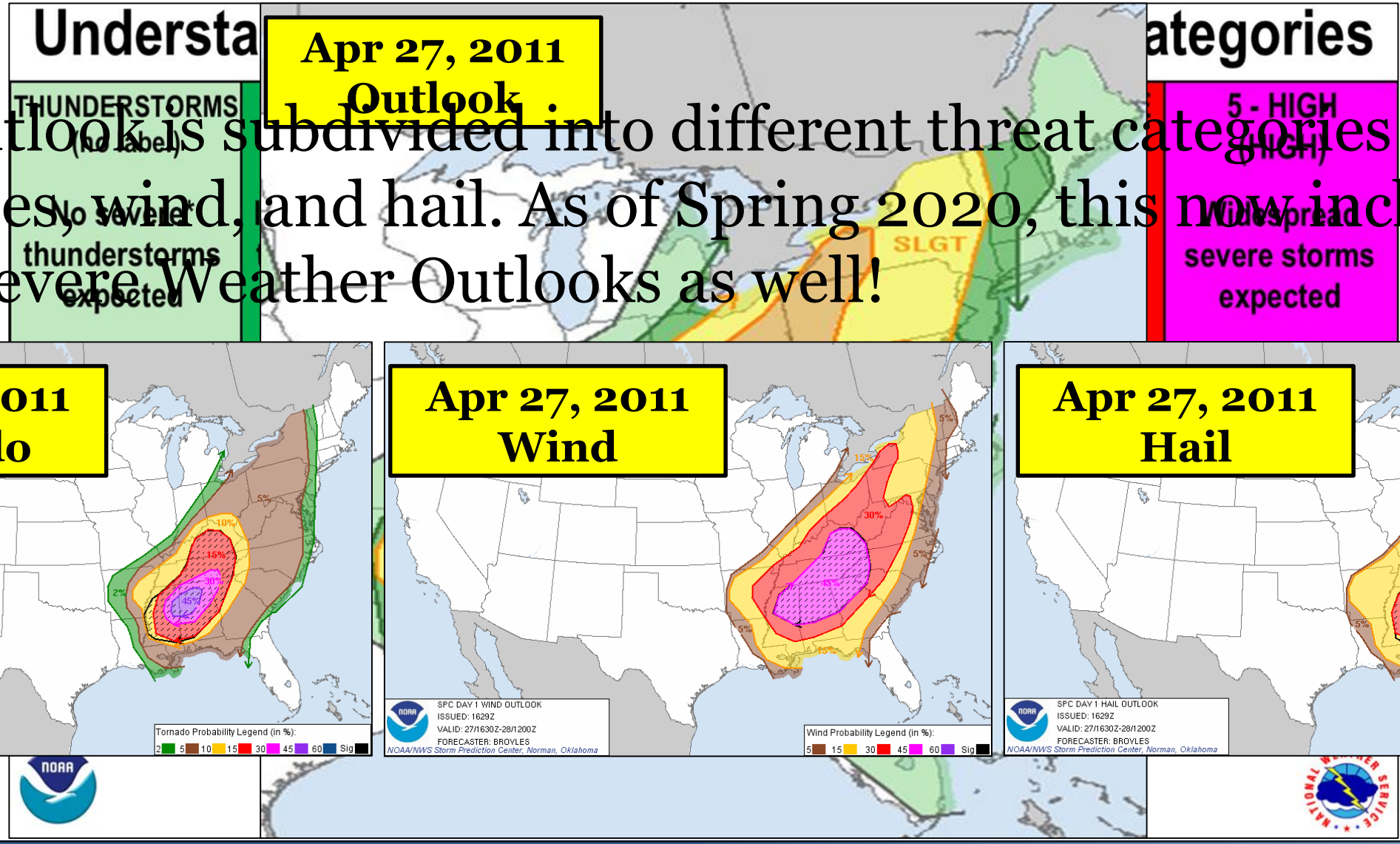
- A variety of other factors can combine to make storms more or less organized
- Generally, the more organized, the greater the severe threat.

Thunderstorm Development 101



Storm Prediction Center Outlooks

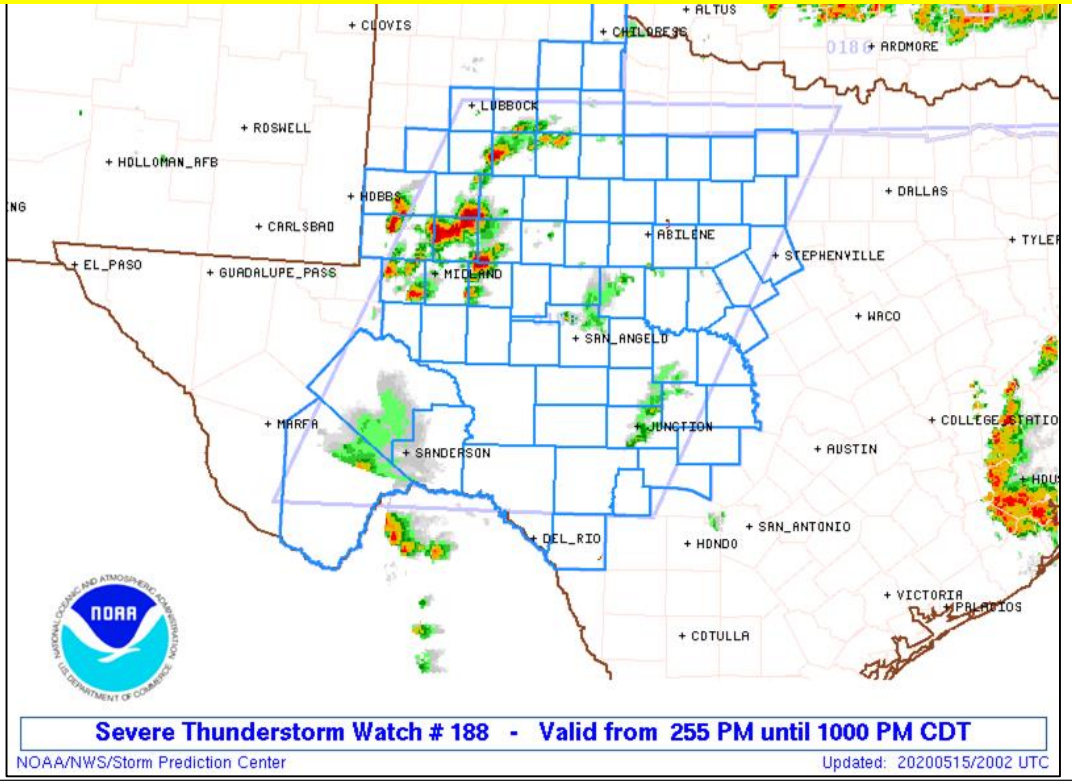
Each outlook is subdivided into different threat categories for tornadoes, wind, and hail. As of Spring 2020, this now includes Day 2 Severe Weather Outlooks as well!



Severe Thunderstorm Watch vs Tornado Watch

A tornado watch means the potential for a tornado is at least moderate. A severe thunderstorm watch can still have tornadoes, but other severe hazards are expected to be of greater impact.

Hazard	Tornadoes	EF2+ Tornadoes	Severe Wind	65 kt+ Wind	Severe Hail	2"+ Hail
Likelihood	Moderate	Low	High	Low	Moderate	Low



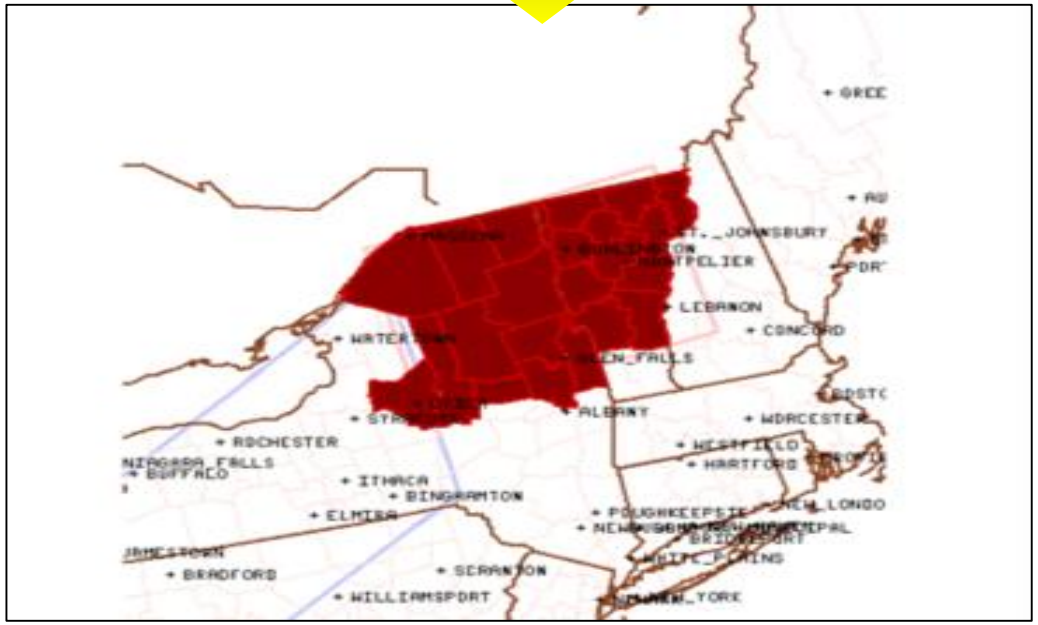
Hazard	Tornadoes	EF2+ Tornadoes	Severe Wind	65 kt+ Wind	Severe Hail	2"+ Hail
Likelihood	Low	Very Low	High	Moderate	Moderate	Moderate

Watch vs Warning

Watch

-Conditions are favorable for severe weather development over the coming **hours.**

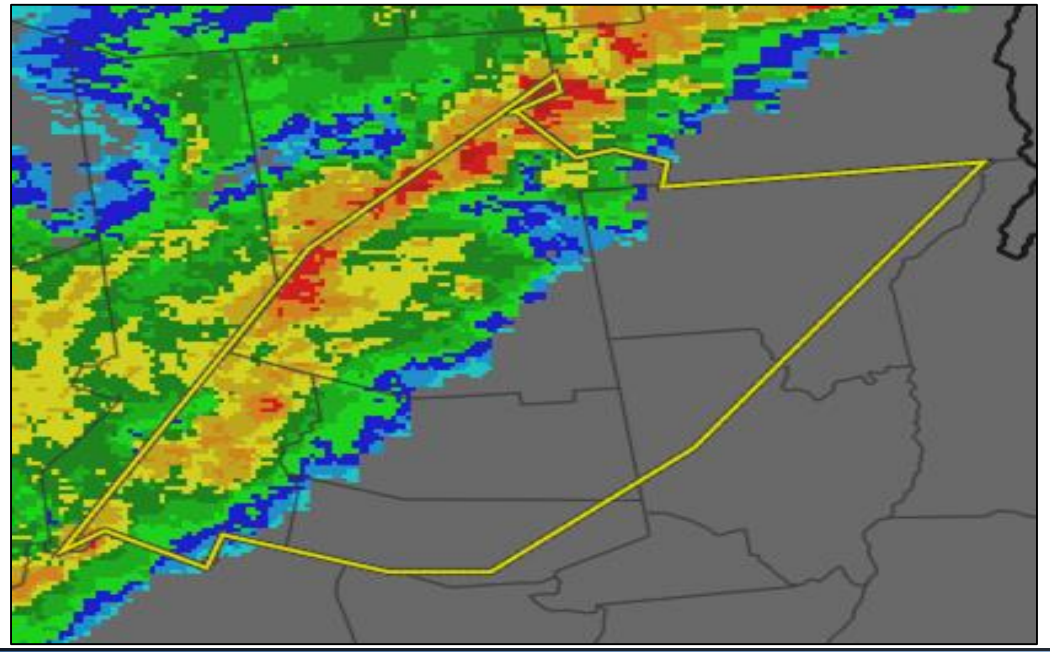
-Remain Alert!



Warning

-Severe weather is **imminent or ongoing**

-***Take immediate action!***



Watch vs Warning

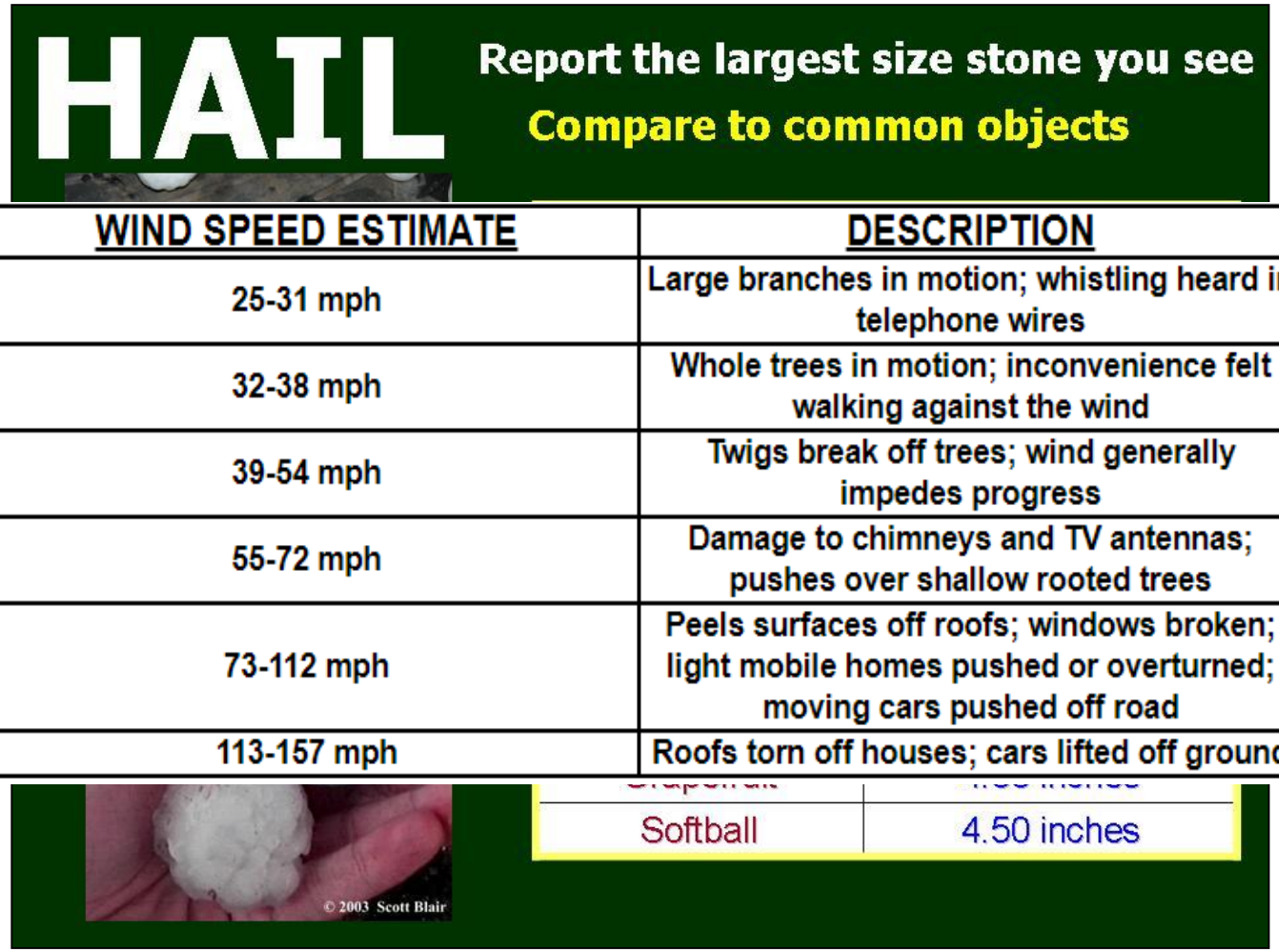
“Cupcake” Ingredients Are Present

“Cupcake” is imminent or already occurring

Any Questions?

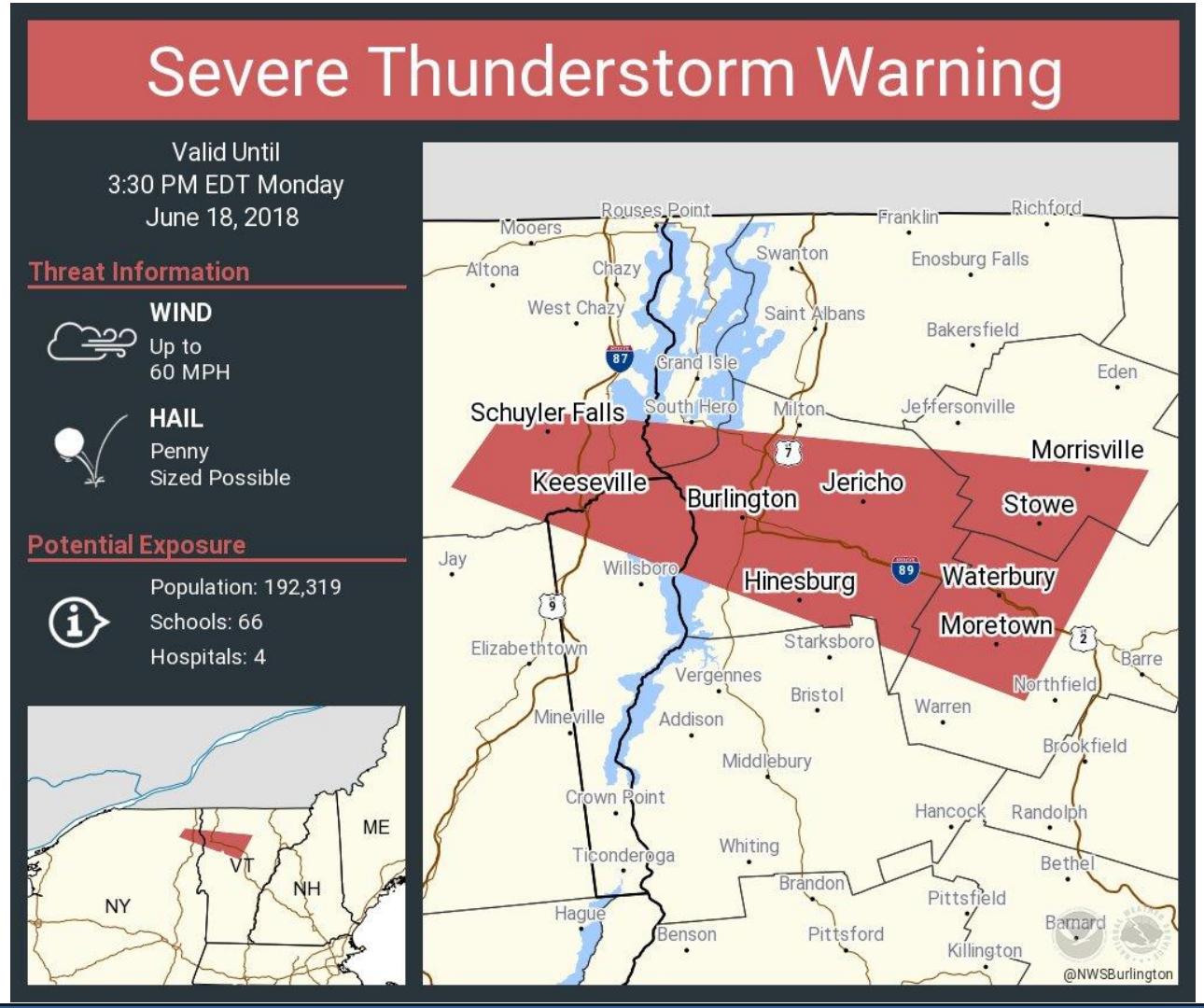
Convective Warnings - Severe, Flash Flood, & Tornado

- Hail 1 inch diameter or larger
- Wind 58 mph (50 kts) or greater
  - *and/or significant damage (trees/large branches or powerlines downed)*
- Wind Damage
- Tornado of any intensity
- No severe criteria for lightning!
  - *But it is a killer*
- Flash flooding makes rivers of areas that shouldn't (roads).



WIND SPEED ESTIMATE	DESCRIPTION
25-31 mph	Large branches in motion; whistling heard in telephone wires
32-38 mph	Whole trees in motion; inconvenience felt walking against the wind
39-54 mph	Twigs break off trees; wind generally impedes progress
55-72 mph	Damage to chimneys and TV antennas; pushes over shallow rooted trees
73-112 mph	Peels surfaces off roofs; windows broken; light mobile homes pushed or overturned; moving cars pushed off road
113-157 mph	Roofs torn off houses; cars lifted off ground

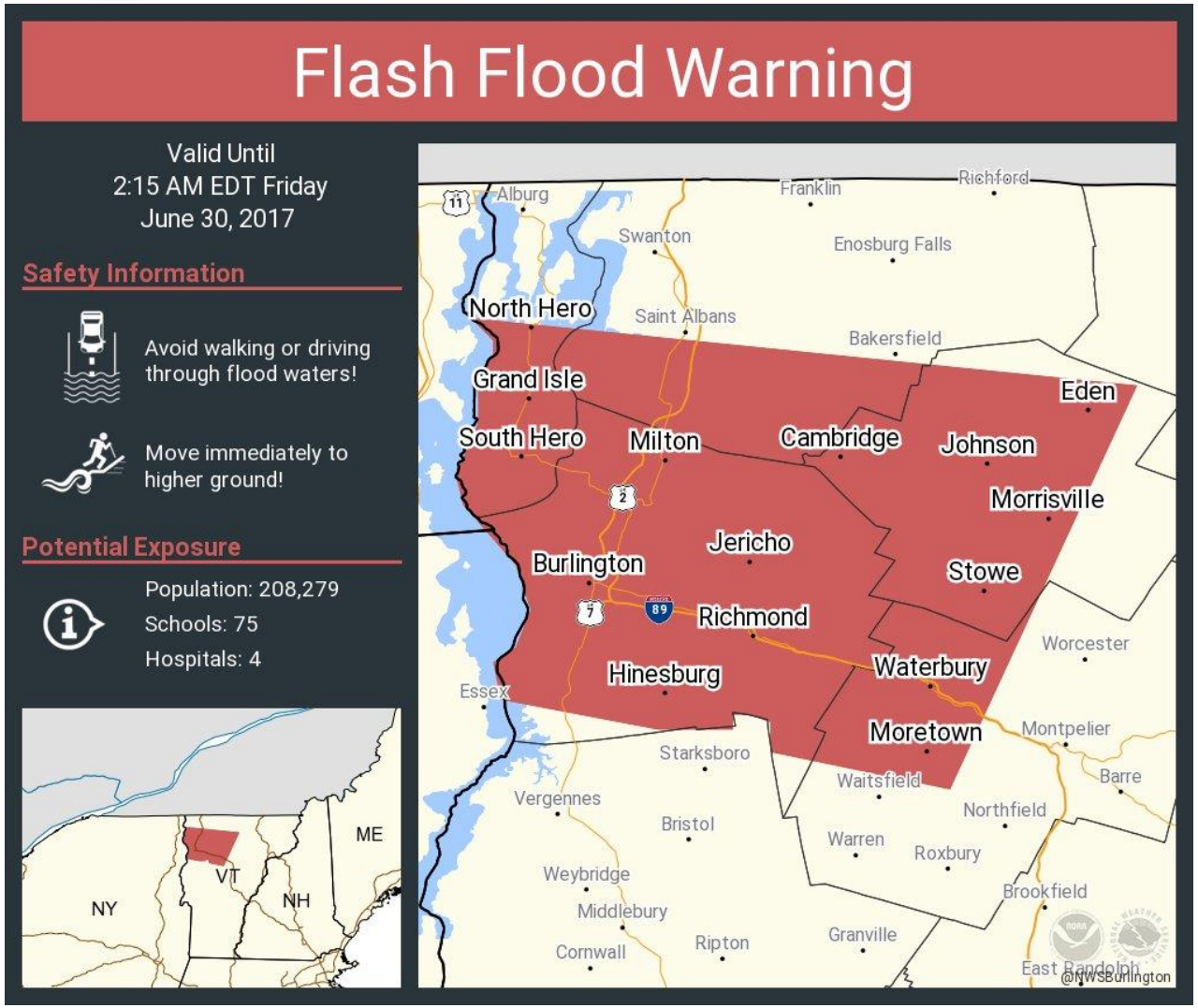
Severe Thunderstorm Warnings



In order for a thunderstorm to be classified as severe, it must produce at least one of the following:

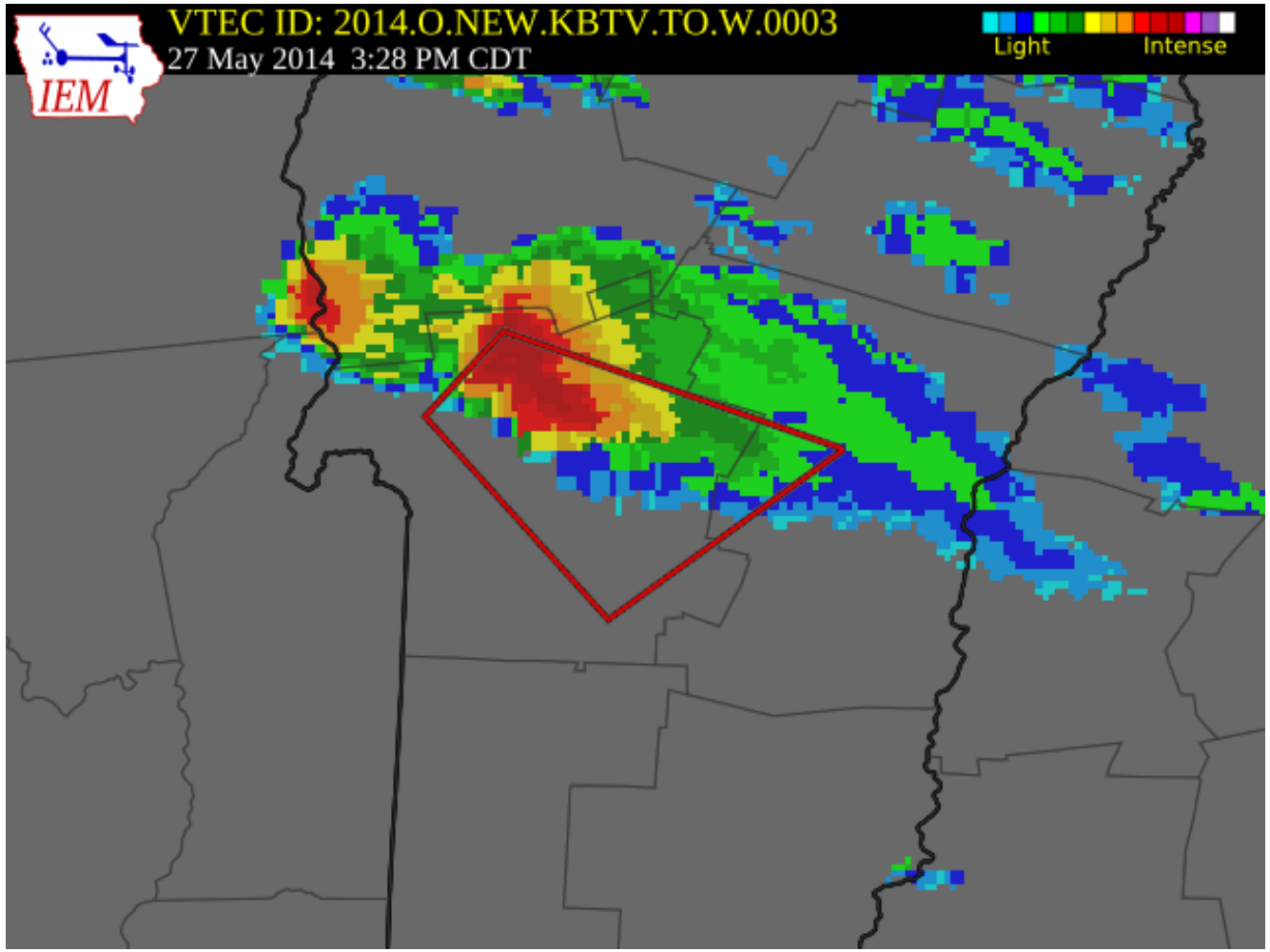
- Hail that is one inch in diameter (about the size of a quarter) or greater.
- Wind gusts of 58 mph or greater.
- A tornado.

Flash Flood Warnings



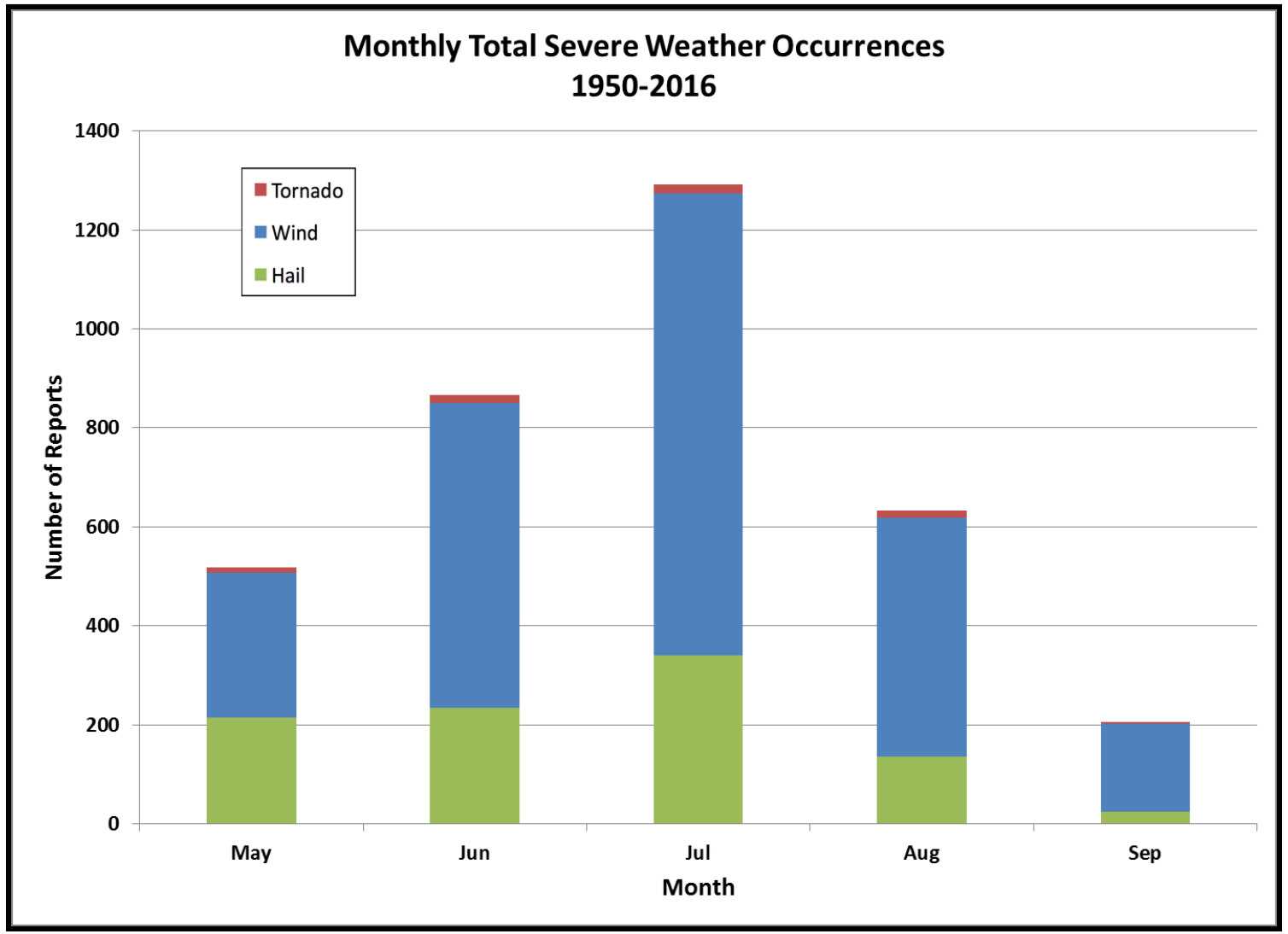
- A flash flood warning indicates that a rapid rise in water has led to or will lead to flooding over the warned area.
- This is characterized as a sudden, violent rise in water following heavy rainfall.
- Topography can play a large role in flooding as water at higher elevations will run off to lower elevations which can allow water to gather.
- Turn Around, Don't Drown! More fatalities are caused by flooding than all other severe hazards COMBINED!

Tornado Warnings



- Very rare to see in the North Country as the Adirondack and Green Mountains tend to keep organized storms/supercells to a minimum.
- A tornado is strong, rotating column of air. Damage ranges from tree damage (EF0) to catastrophic building damage (EF5).
- The strongest tornado to occur in Vermont was an EF2. This has happened multiple times.

Brief Overview of Thunderstorm Types and Hazards



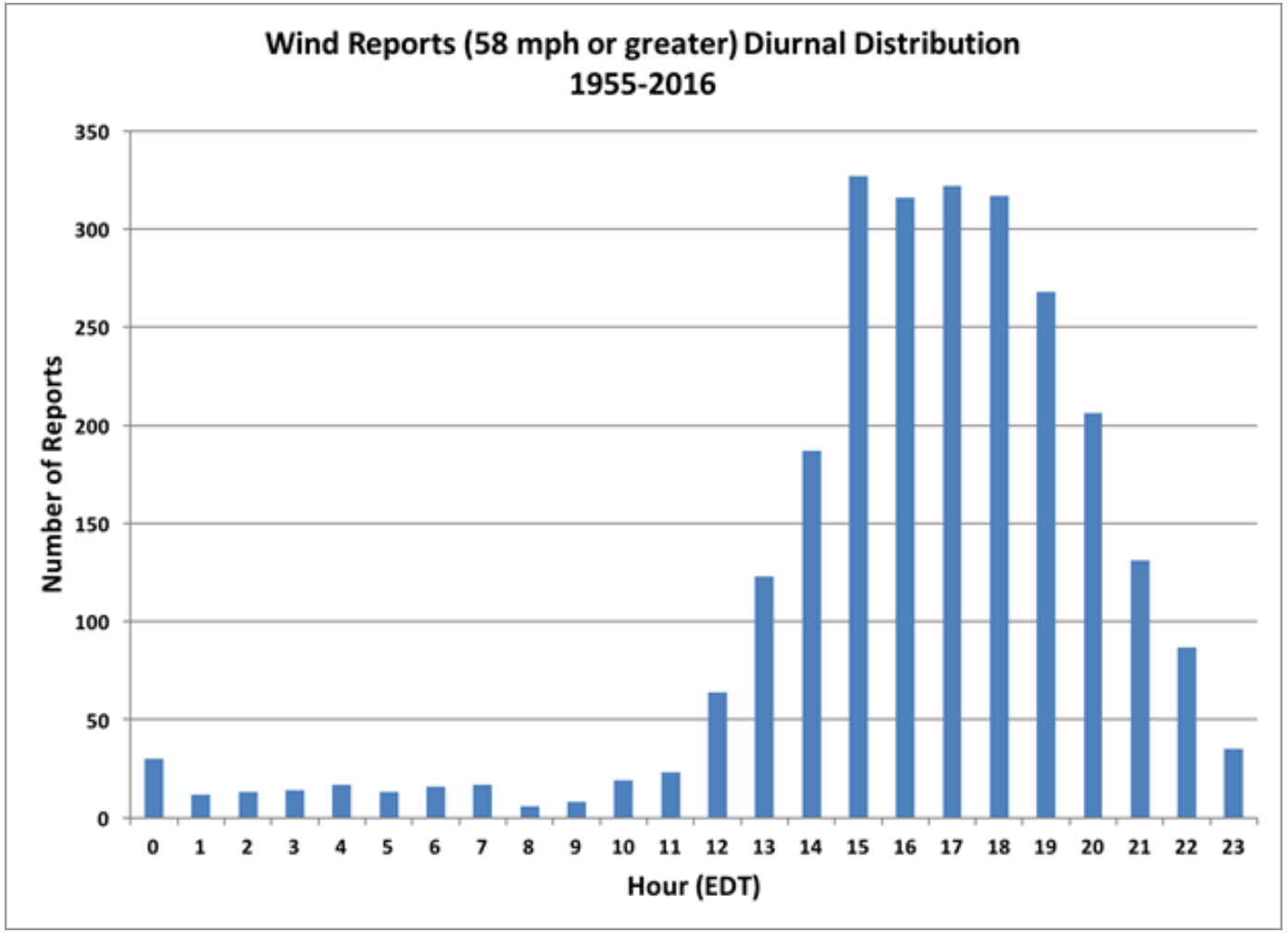
Climatological period of Severe Weather is the height of summer

Why is this so?

- More daytime heating – greater atmospheric instability
- Bermuda high usually allows moisture from the Gulf of Mexico advance northwards.
- While areas like Florida don't get fronts in the summer, we can still get weak frontal boundaries that help storms develop.

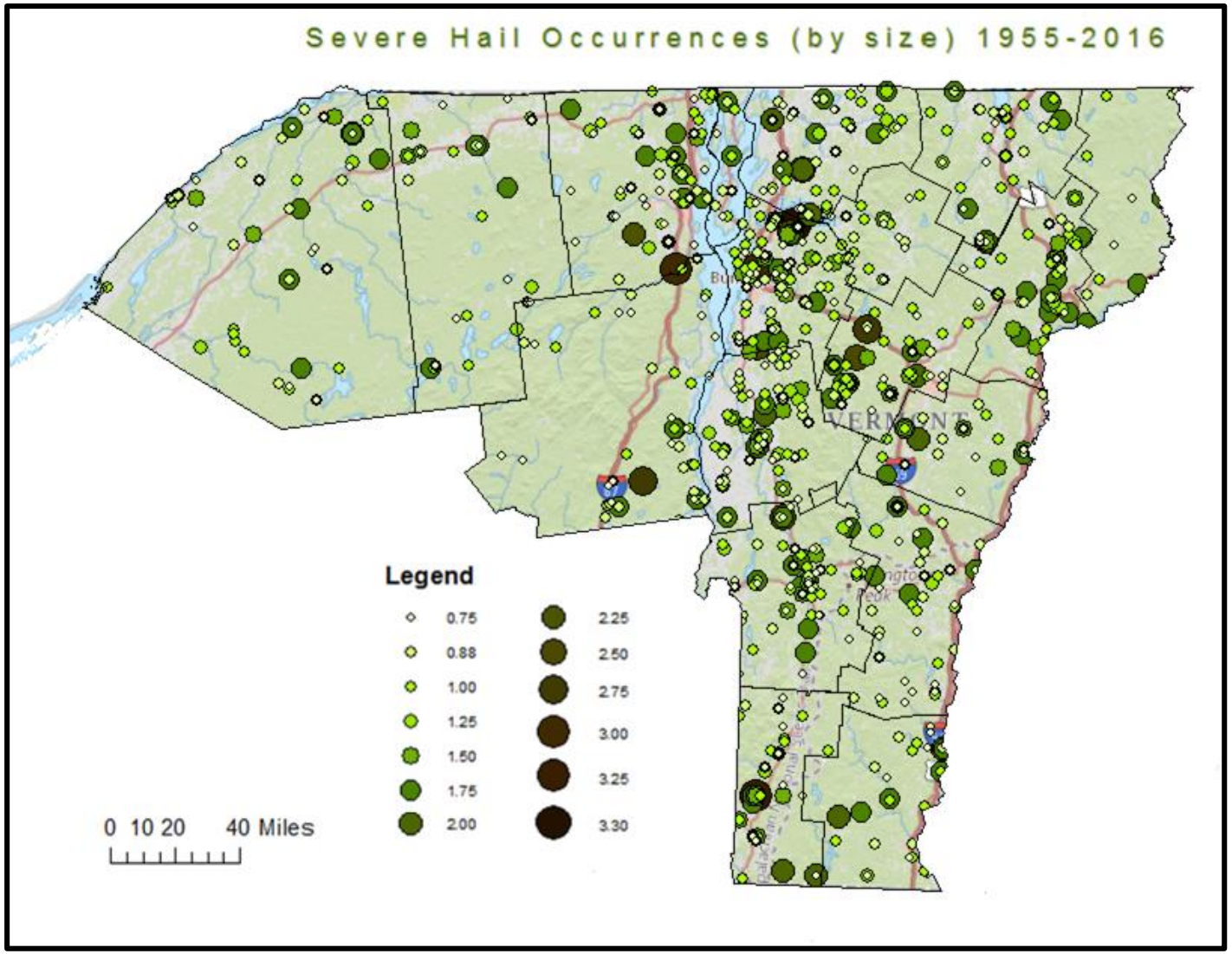
North Country Severe Weather Climatology

- In general, severe weather, occurs between 1 PM and 10 PM EDT in the North Country



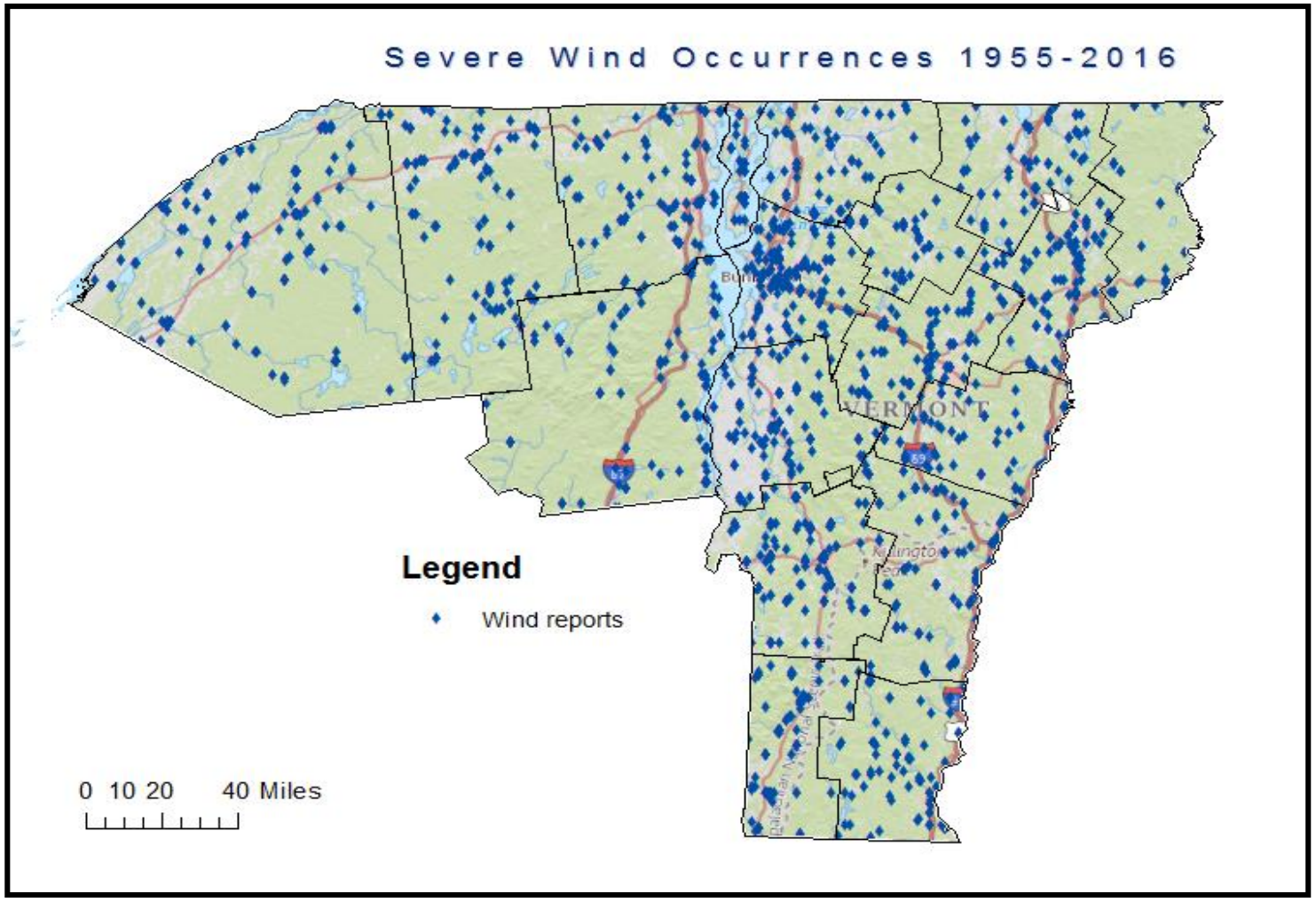
North Country Severe Weather - Hail

- Noticeable concentrations of reports around
  - Burlington, VT
  - Middlebury, VT - Rutland, VT
- Also note clusters along road networks



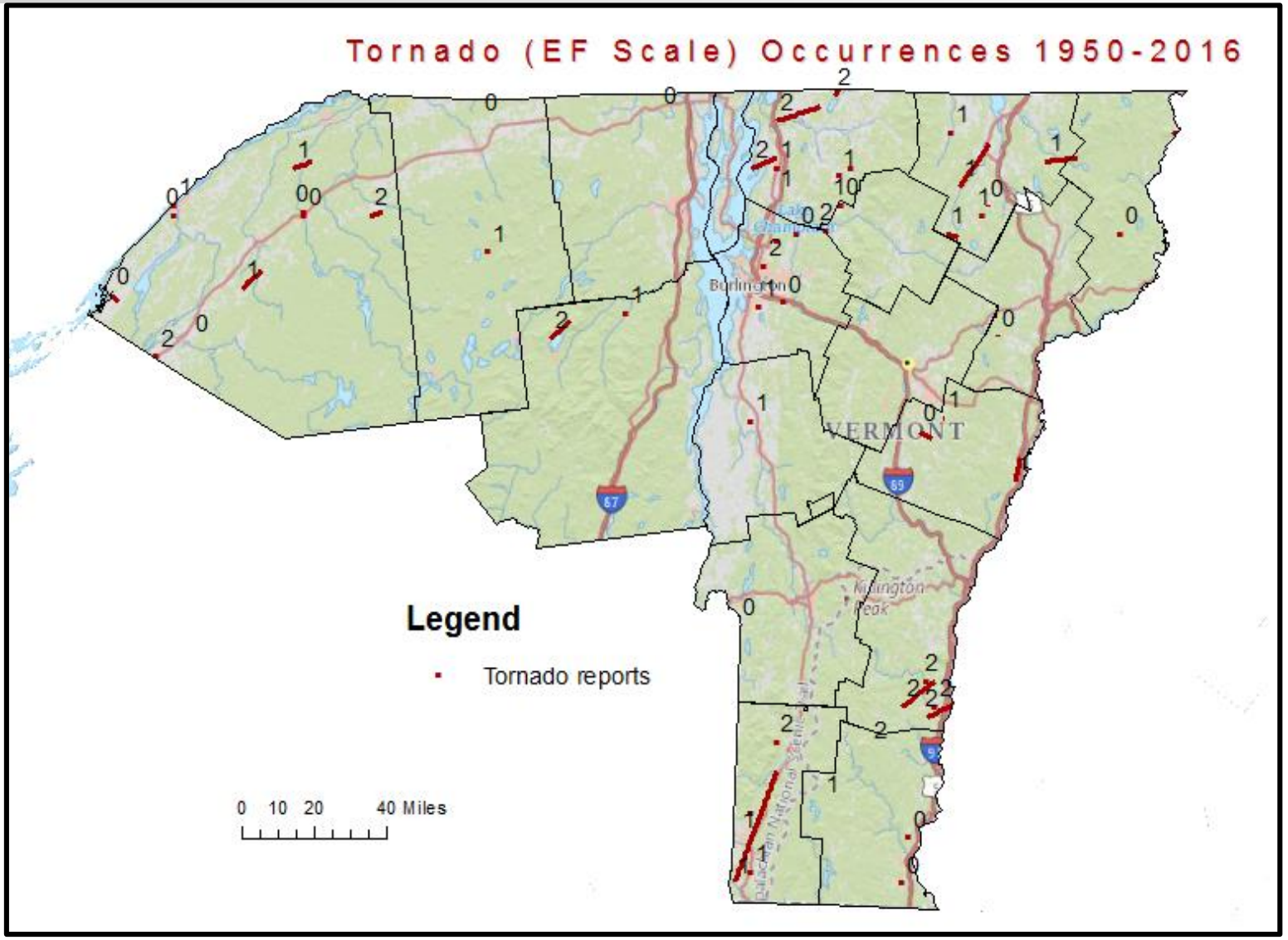
North Country Severe Weather - Wind

- Less noticeable association between wind reports and population
- Large cluster still around Burlington area
- More wind reports over St. Lawrence valley compared to hail



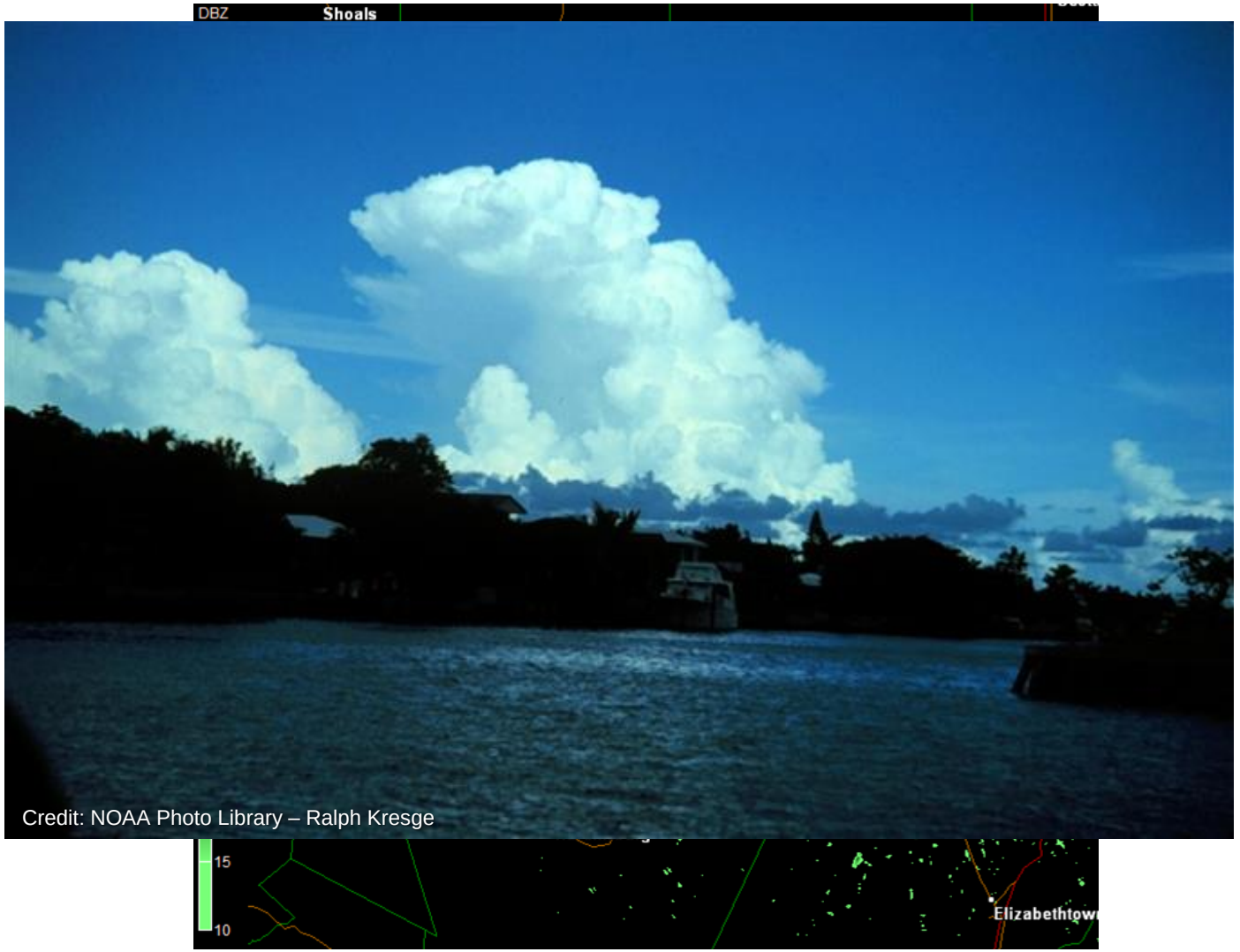
North Country Severe Weather - Tornadoes

- No noticeable correlation between population and tornado reports
- More terrain influenced
- Wasula et al. (2002) noted N-S oriented river valleys important in veering profiles during tornado occurrences



Any Questions?

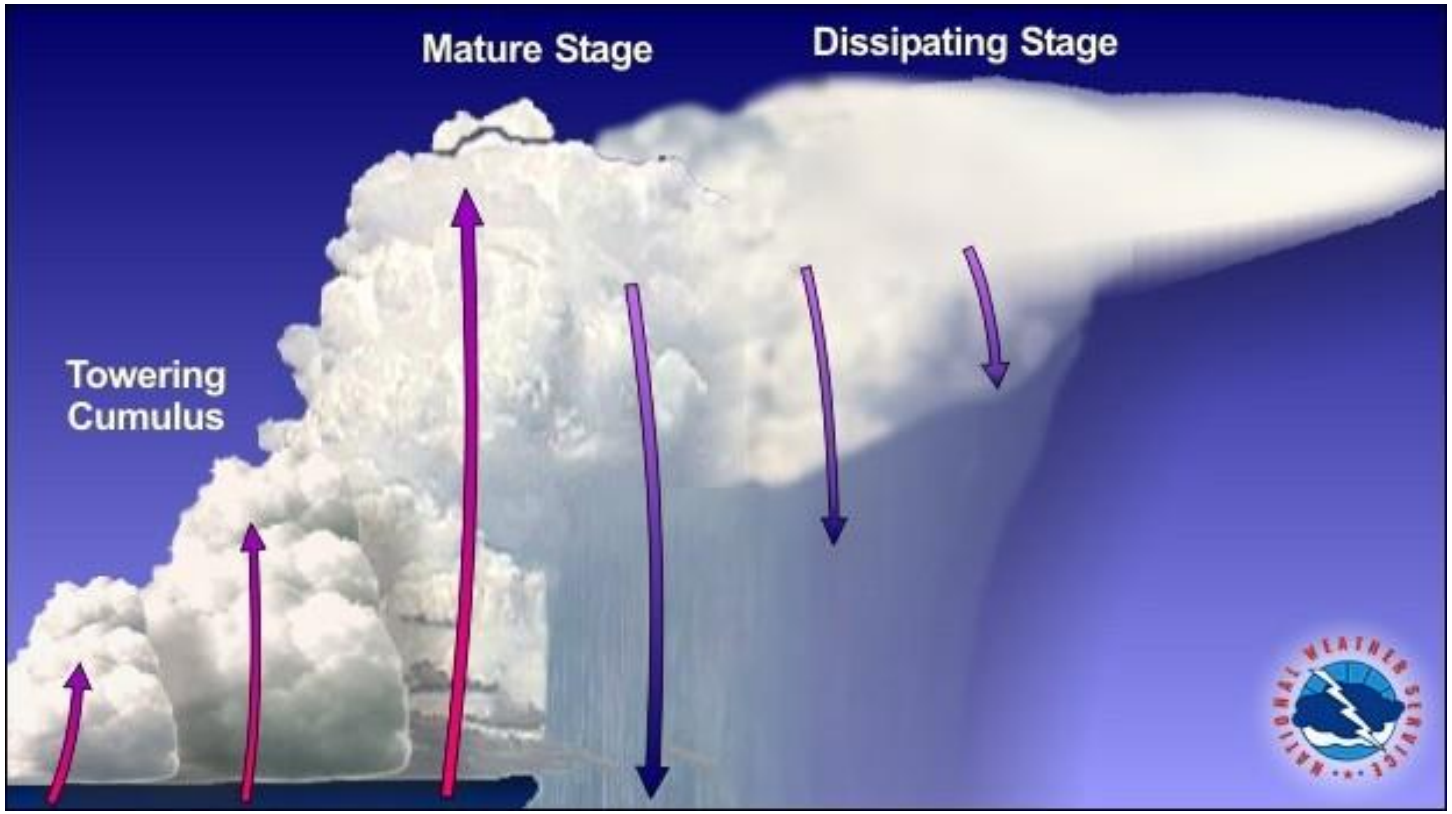
The Single Cell



Credit: NOAA Photo Library – Ralph Kresge

- Often referred to as “popcorn” thunderstorms. Single cell thunderstorms are small and brief and are rarely severe.
- They are driven by afternoon heating in a conditionally unstable environment.
- These storms can produce brief heavy rainfall and clusters of lightning strikes.

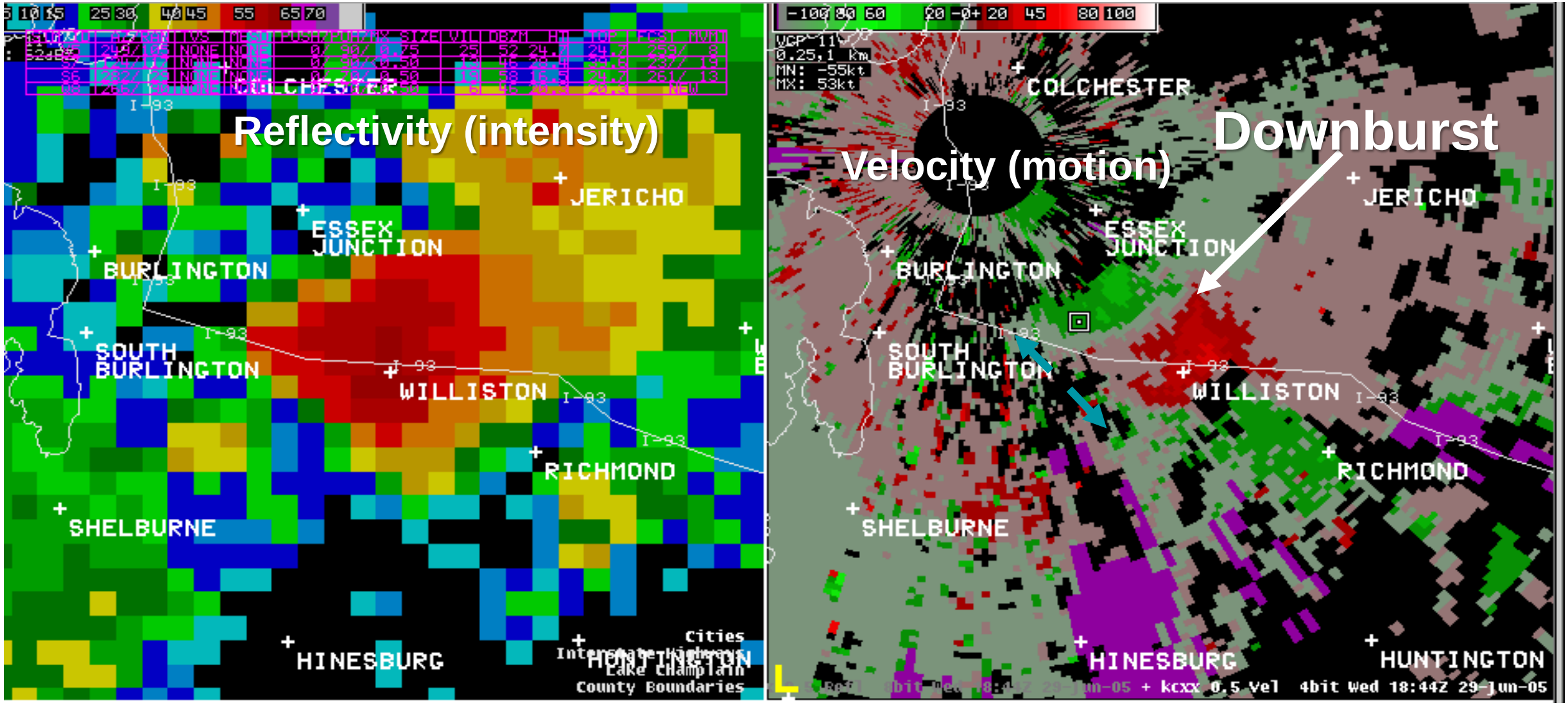
The Single Cell



- Downdraft overtakes the convective updraft.
- Causes the storm to dissipate, usually within an hour.
- Sometimes, the downdraft wind is strong enough to do minor damage.
- Look for an overshooting top above the anvil – indicates more vigorous updraft and likelihood for damaging winds.

Microburst Visual Appearance

Microburst on Radar - Williston June 29, 2005

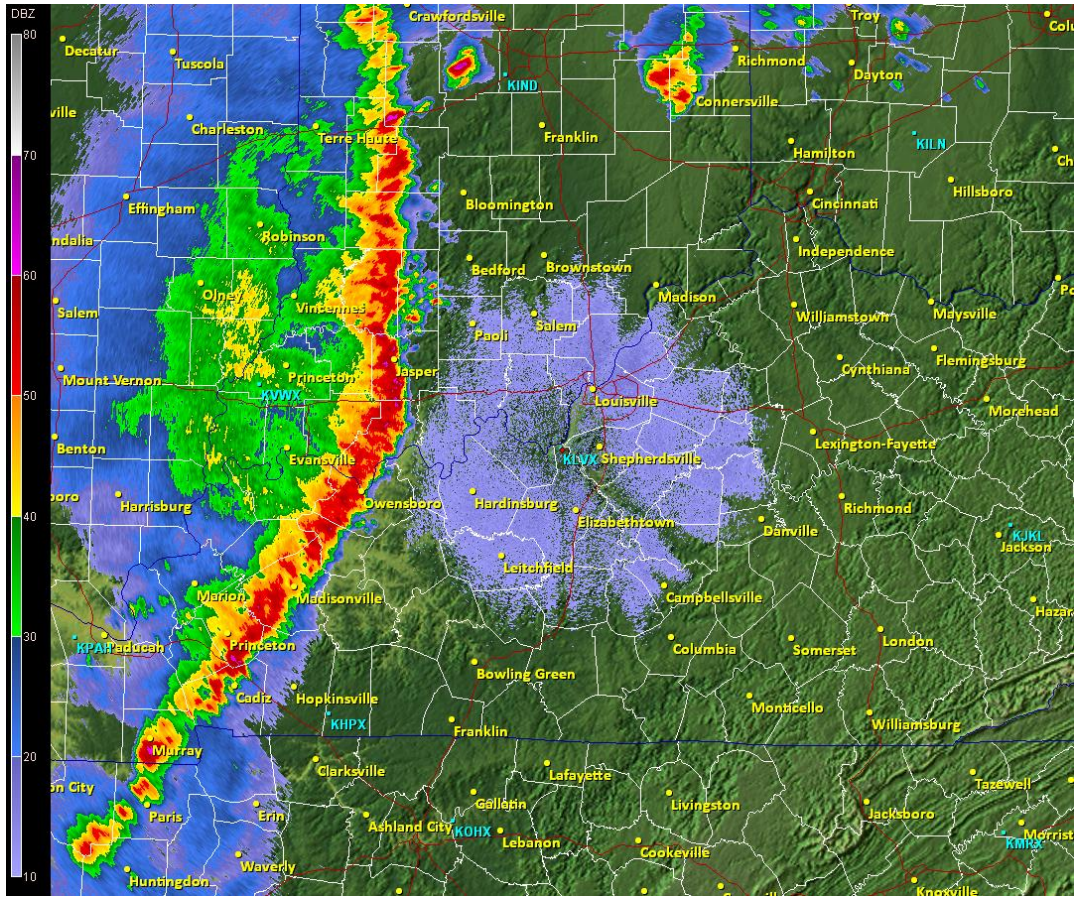


Multi-cell (Many Thunderstorms or Pulses)

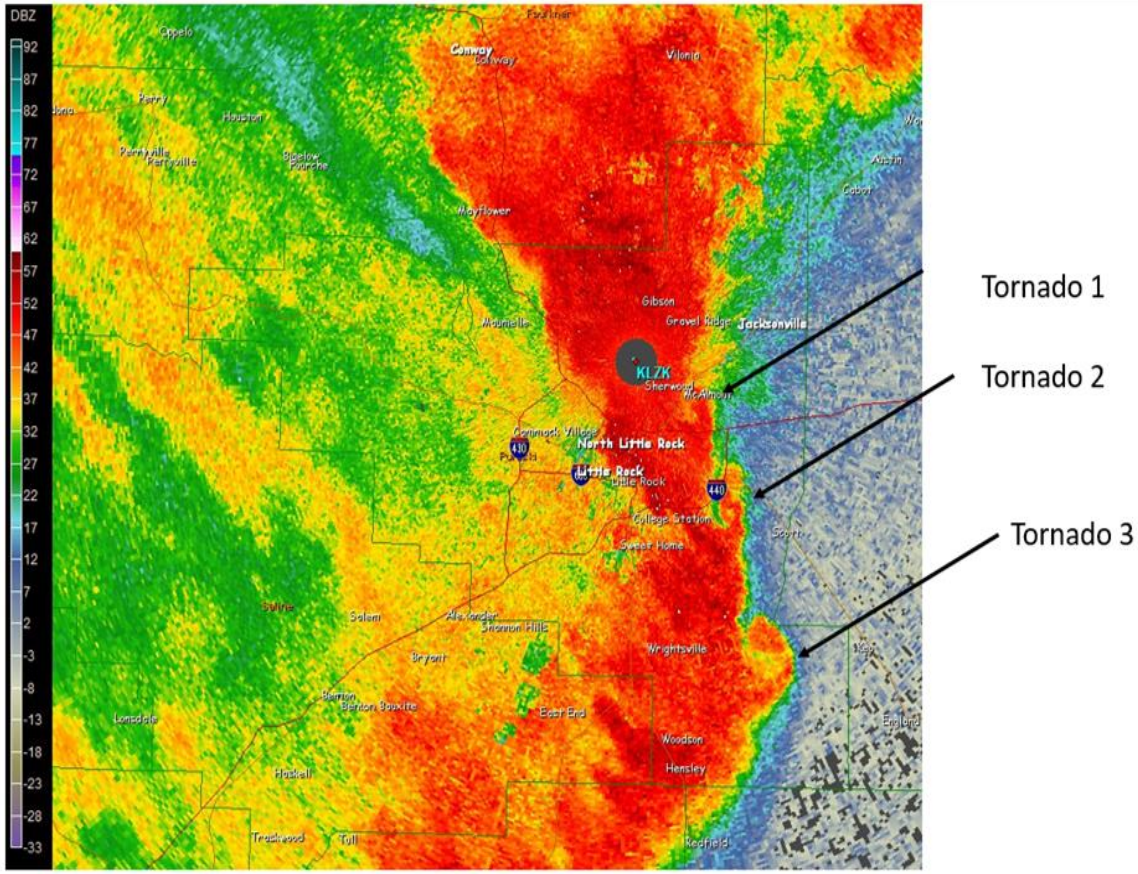
Credit: NOAA Photo Library – Ralph Kresge

- More organized than the single cell.
- Very common over the summer months which is formed by the merger of multiple single cell thunderstorms.
- New storms form along the leading edge of rain cooled air (aka gust front).
- These types of storms can be severe and produce wind, hail and a low chance of a tornado.
- Flooding is possible for slow moving multi-cell storms if rainfall continuously moves over the same areas.

Squall Line (Quasi-Linear Convective System)



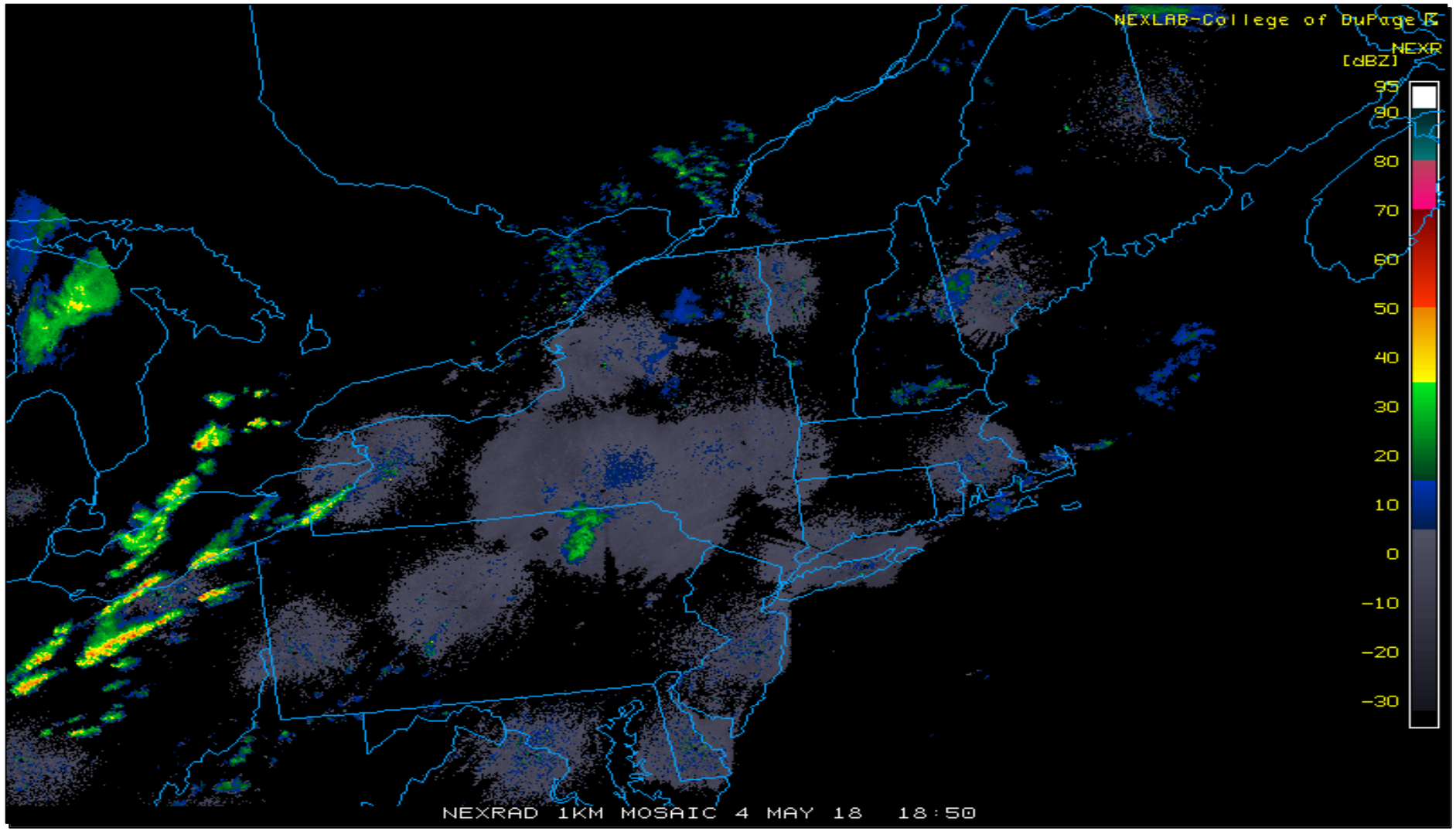
Squall line - Group of thunderstorms that are often accompanied by high winds and heavy rain. Less prone to tornados. Can be hundreds of miles long.



QLCS - Very specific squall line that can produce intense winds and short-lived tornados on the leading edge as seen above.

Line Storm – Straight Line Wind Damage

Multi-cell Clusters Can Organize into a Squall Lines



Shelf Clouds

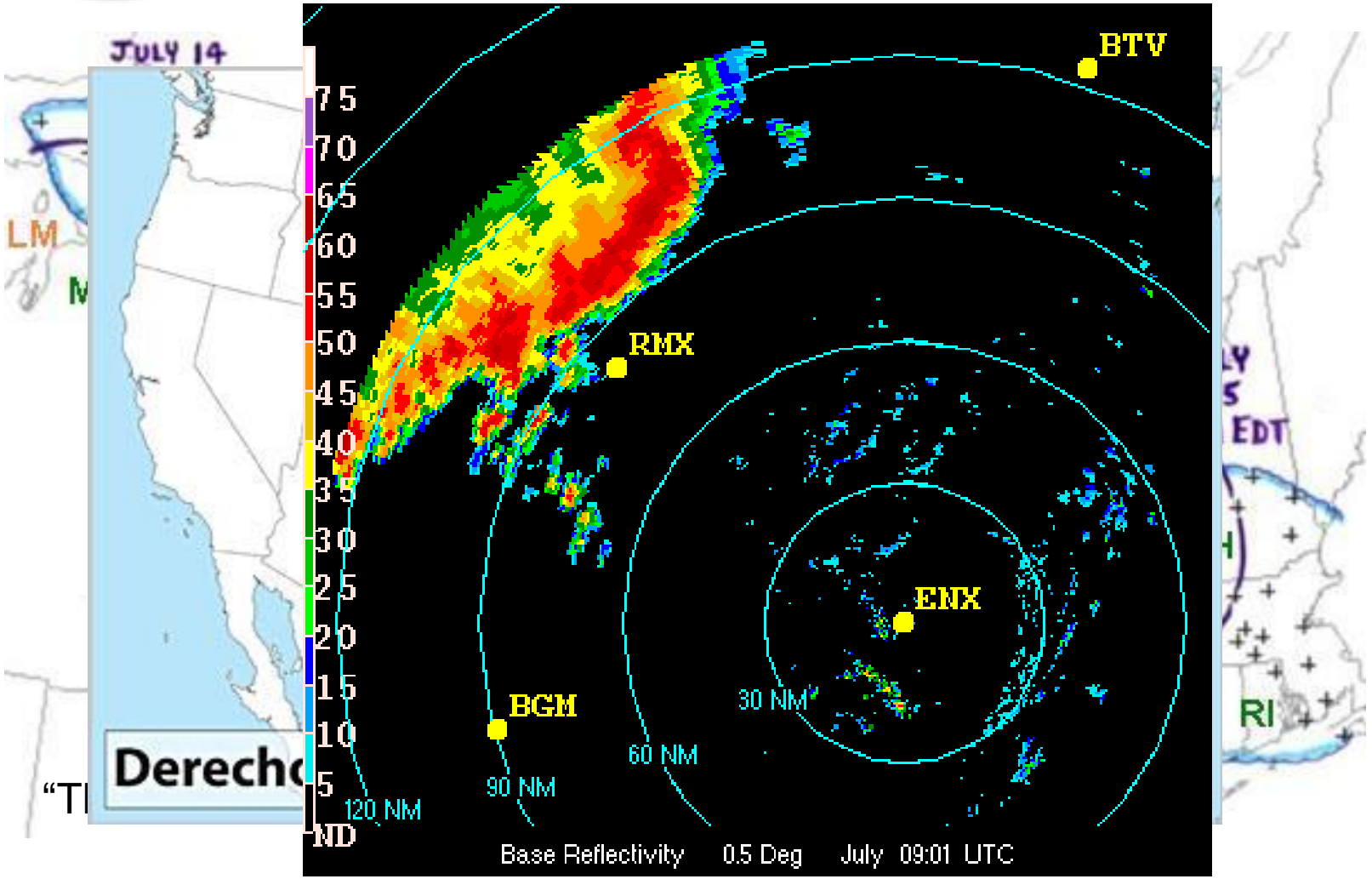
June 8, 2008, Colchester, VT

Shelf Cloud at BTV on May 29th 2020
Photo Courtesy of Conor Lahiff

Often, squalls are accompanied by shelf or roll clouds. When you see these, you are likely in for very heavy rain and damaging winds.

These clouds develops as a result of turbulence caused by cold outflow from heavy precipitation overriding warm inflow into a thunderstorm.

Derecho



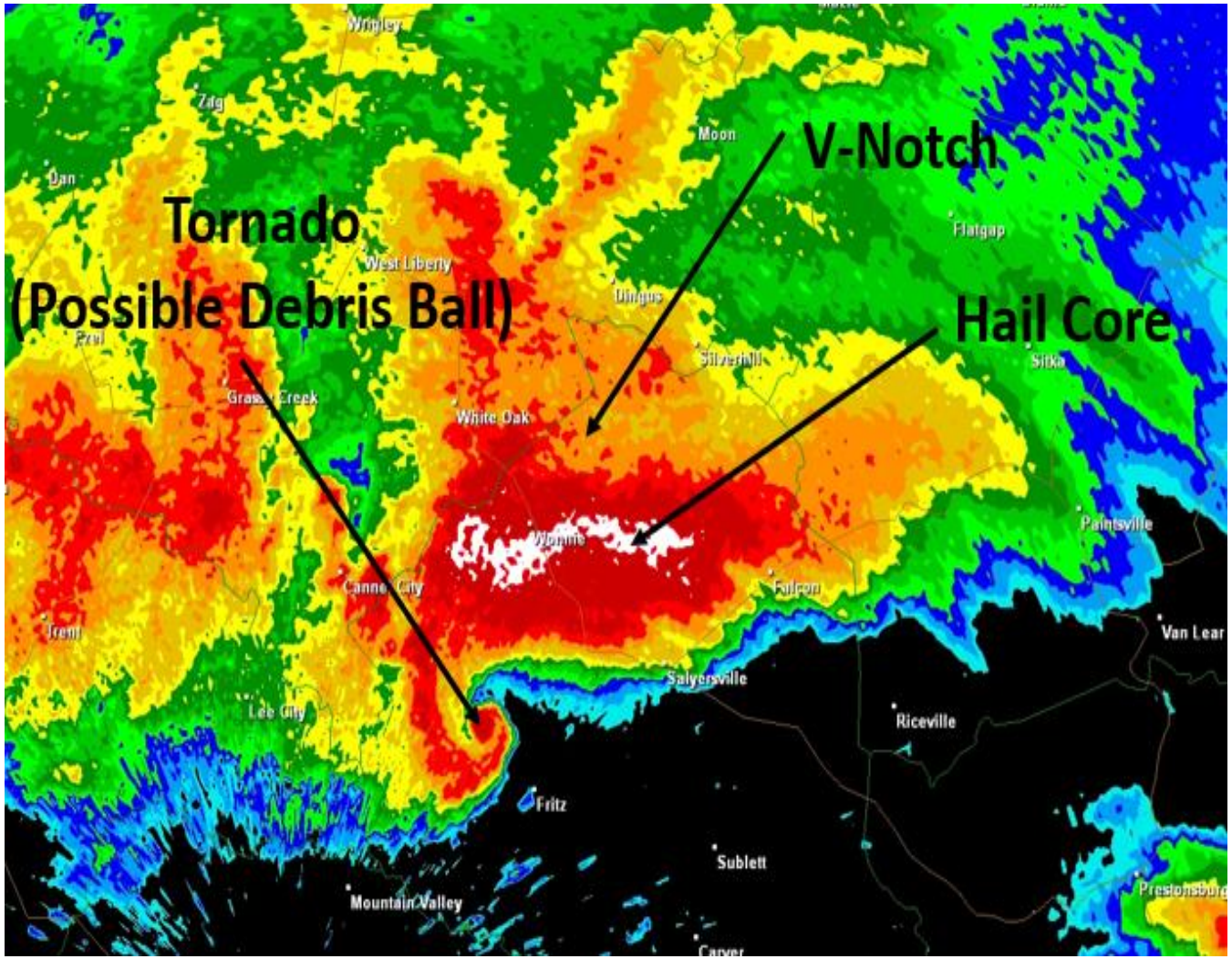
A derecho is defined as a line of intense, widespread and fast-moving windstorm.

Can also be a line of thunderstorms that moves across a great distance and is characterized by widespread wind damage.

Can produce damage comparable to a tornado.

The main difference between a derecho and bow echo/squall line is the extent of the areal coverage of wind damage.

Supercells



- Highly organized thunderstorm that feeds on a strong updraft that is both tilted and rotating. This feature is known as a mesocyclone.

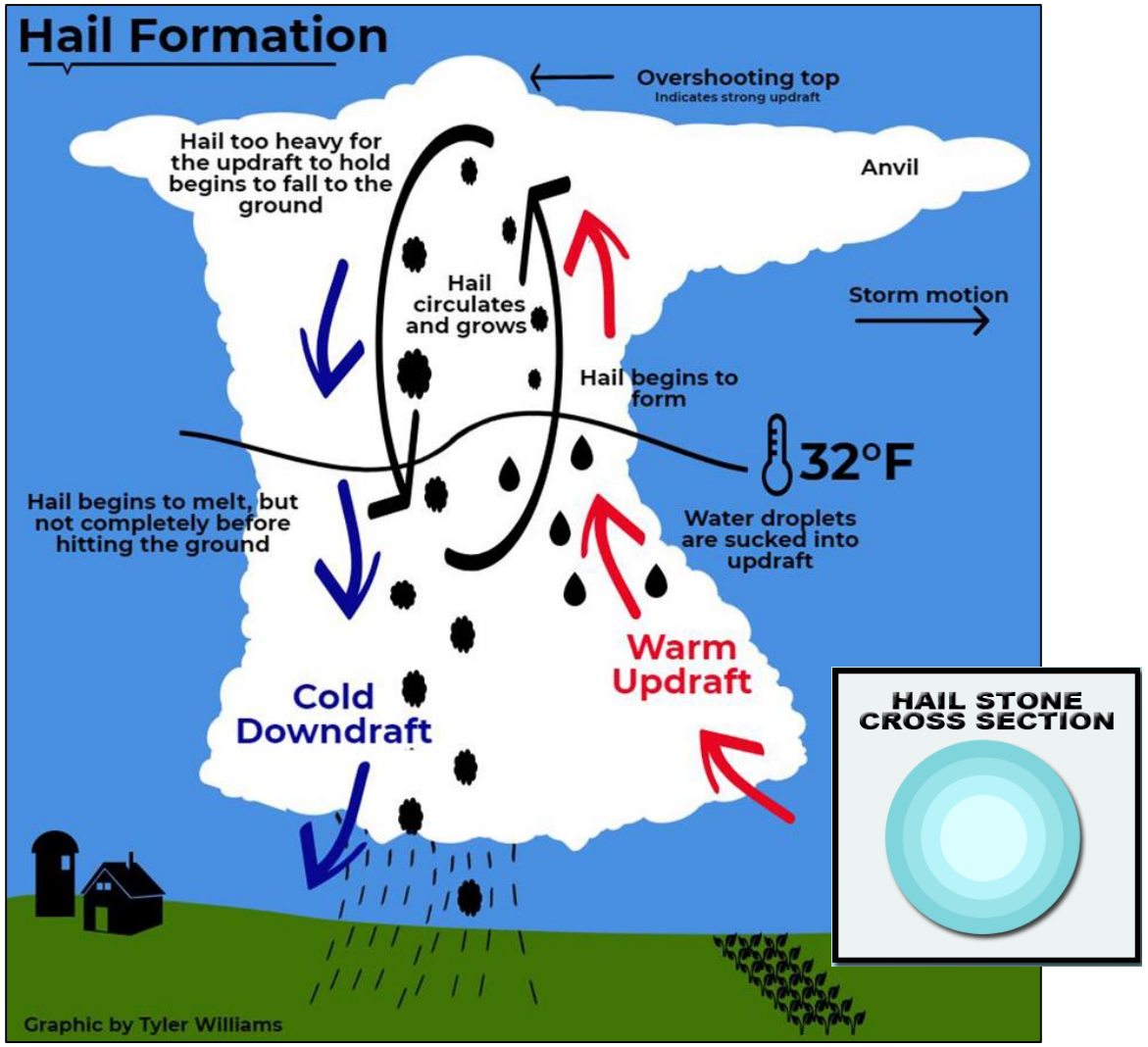
- Seen on radar as a “hook” echo
  - Rain wraps around.
  - When a tornado reaches the ground it can kick up debris that shows up on radar.

Supercells

Supercell photo as part of VORTEX2 – Sean Waugh

- Can exceed storm tops of 50,000 feet!
- Most likely type of storm to produce a tornado.
- Also capable of dropping very large hail up to 2-4 inches in diameter (Look for blues/green colors within clouds).
- Can last 20-60 minutes but can also persist longer in a favorable environment.
- About 1 out of 5 produce tornadoes.

Hail Formation and Growth

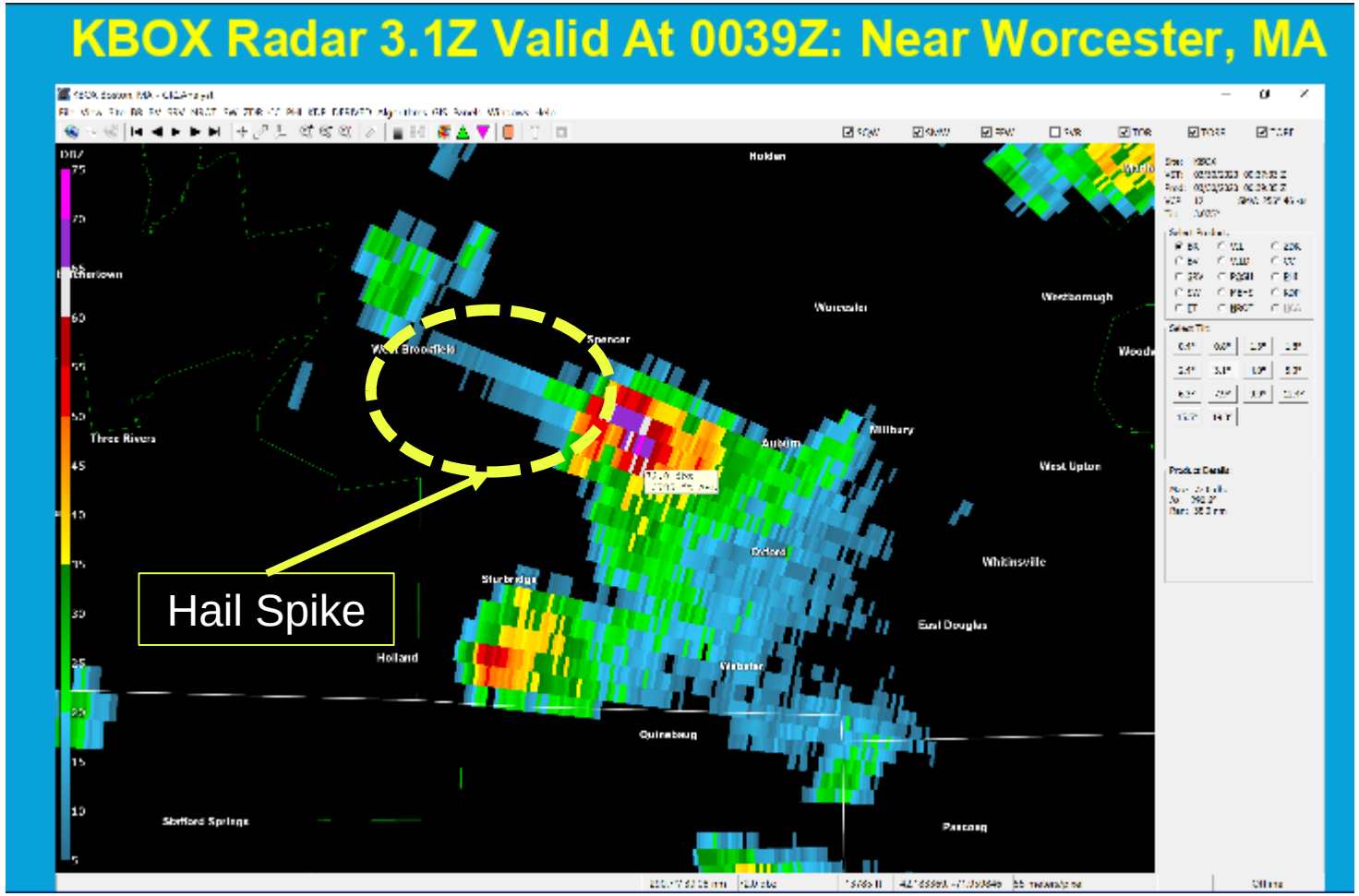


- Hail is more likely when updrafts are strong and the freezing level is low in the atm

- Hai your upd re sep

- Supercells can produce hail, even in unlikely scenarios. This is a great example from a supercell near Massena, NY on October 1st, 2019 where it was only 60 F.

Hail on Radar

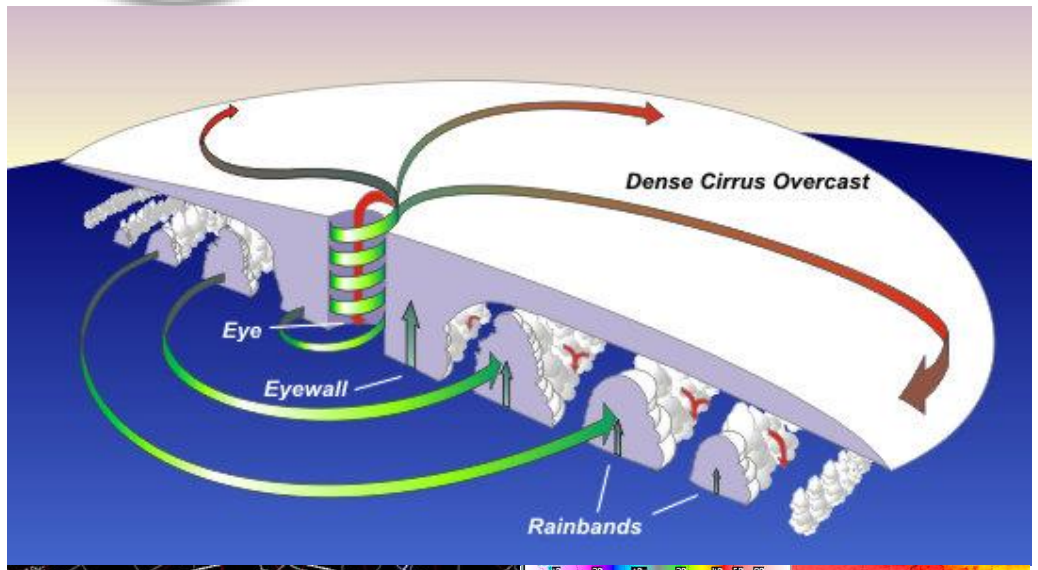


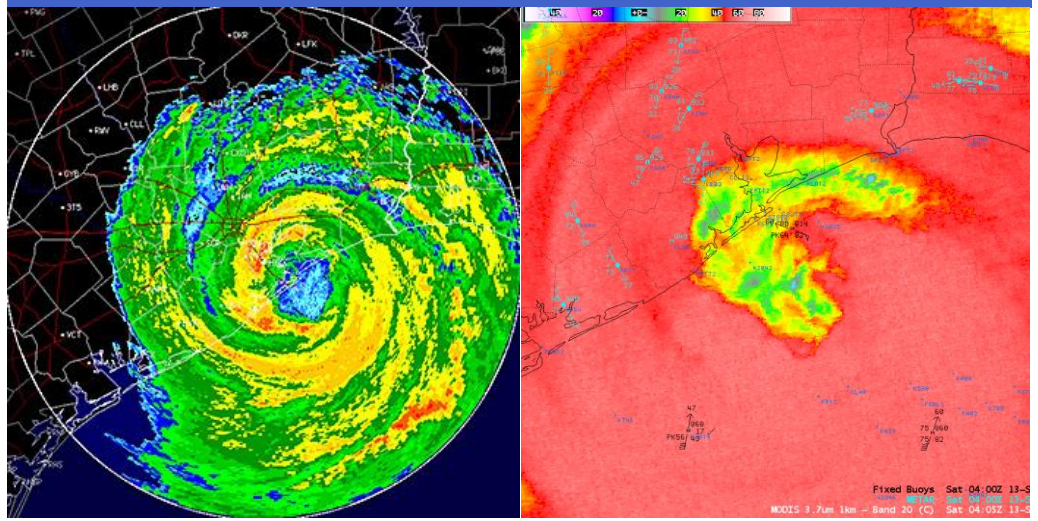
- Hail scatters the radar beam quite differently from rain.
- Most commonly you'll see a "three body scatter spike" – or simply hail spike – when dealing with large hail.

Vermont Record Hail
Westford, VT July 16, 2009

- Measure hailstone from tip-to-tip
- And do it fast! That hail is melting.
- And if you get record hail, make sure to back it up with a photo.

Tropical Cyclones





Radar and IR Satellite image of Ike before landfall

- Concentrated areas of thunderstorms over warm ocean waters results in falling pressures, that in the right environment becomes an organized, convectively driven area of low pressure (hurricane - see image to the left).
- When over land, greater friction and lack of warm, ocean waters causes these systems to quickly decay.
- Warm rain processes (small drops, but numerous in count) results in high rainfall rates, especially if the system is moving slowly or quite large.
- Can cause isolated tornadoes
- Often causes wind damage and storm surge (coastline only)

Storm Types (or Convective Modes) Review

	Damaging Winds	Large Hail	Flooding	Tornadoes
Single Cell	Downdraft winds	Highly dependent	Highly dependent	Unlikely
Multicell	Downdraft winds	Possible	Possible	Highly dependent
Squall Line	Straight-line winds	Possible	Possible	Possible
Supercell	Violent Downdrafts	Very large	Possible	Likely
Tropical Cyclone	Strong sustained	Unlikely	Likely	Possible

Any Questions?

Let's Talk About Tornadoes

- Tornado: A violently rotating column of air <u>in contact with the ground</u>
- Rare, 1 every 2 years in Burlington's area

Tornado look alikes

- Scud/Convective Debris
- Ask is it attached to the cloud? Are you mistaking a rain shaft for a cloud?
- Is it moving up into the cloud (funnels descend) or is it rotating?
- If asking us to evaluate, these questions are hard to answer without video or time of occurrence (helps us match to what we see on radar).

Weak Tornadoes

(EF0 and EF1)

- 80% of all tornadoes
- Less than 5% of tornado deaths
- Lifetime: 1 - 15 minutes
- Path: Up to 3 miles
- Wind speed: 65 - 109 mph
- Most North Country tornadoes

Strong Tornadoes
(EF2 and EF3)

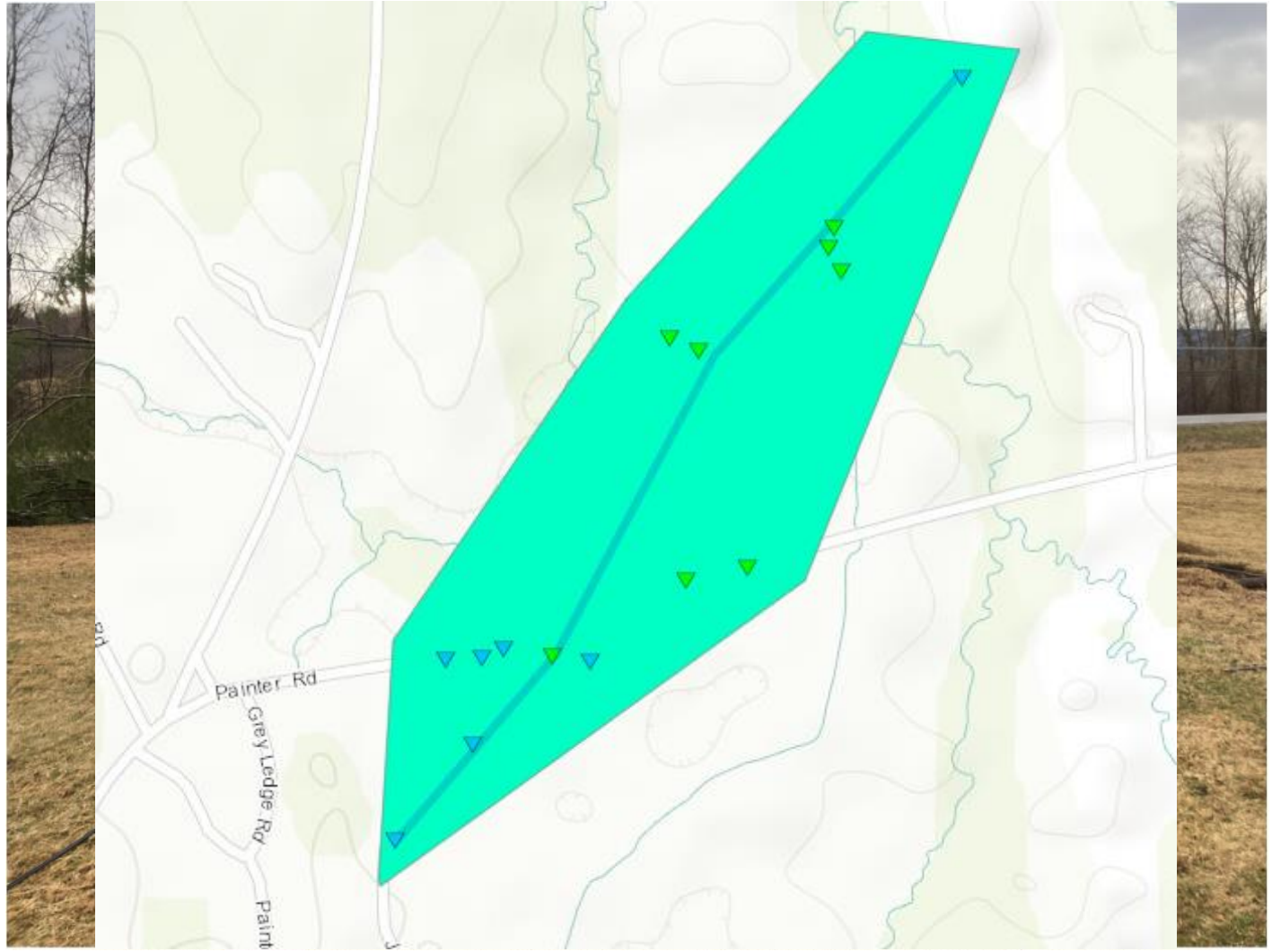
- 19% of all tornadoes
- Less than 30% of tornado deaths
- Lifetime: 20 minutes or longer
- Path: 15+ miles
- Wind speed: 110 - 167 mph

Violent Tornadoes
(EF4 and EF5)

- 1% of all tornadoes
- 70% of tornado deaths
- Lifetime: One hour or longer
- Path: 50+ miles
- Wind speed: 168 -234 mph

Storm Survey – Middlebury, VT's recent tornado

- When we get reports of a possible tornado, we collect as much info as possible. We track radar signals, match it with reports, plan, and investigate.
- Enhanced Fujita scale is a thoroughly researched roadmap of what wind speeds cause what damage.
- Using that, we assign the value based on the damage we see (So if there's no damage, we can't classify it – marked unknown)
- Mark the lat/lon and map it together, we get its width and path length.



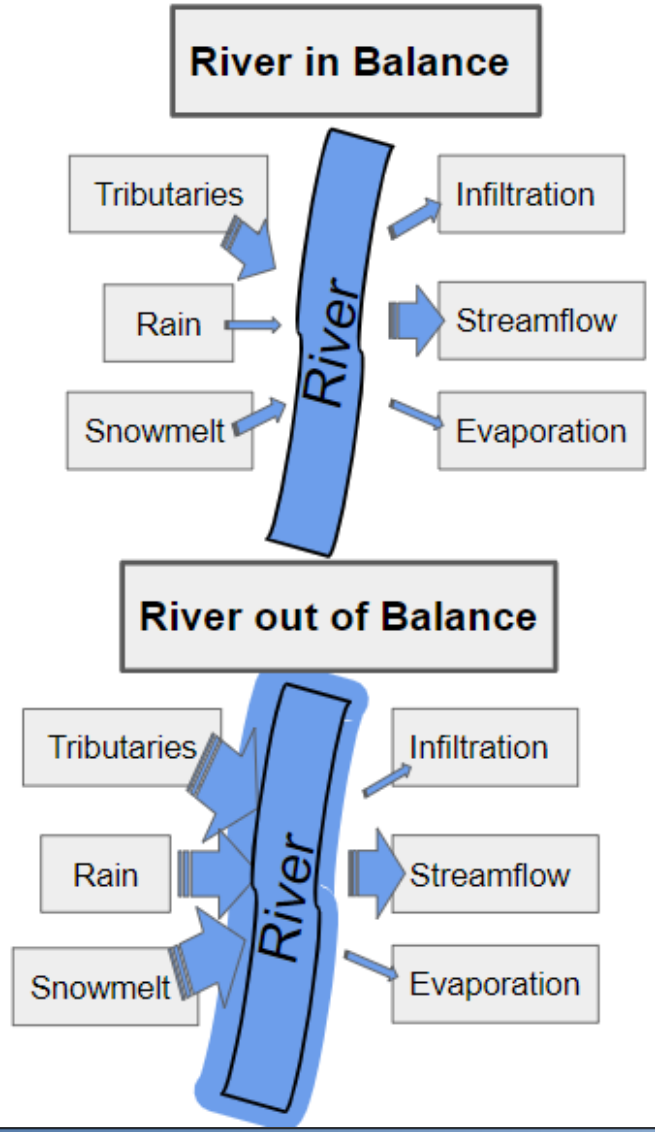
Any Questions?


FLOOD WARNING
A Flood Warning is issued when flooding is happening or will happen soon. Some roads will be flooded.
Move to higher ground.
Never drive through flooded roads.
take action.
FLOOD WATCH
A Flood Watch is issued when flooding is possible.
Stay tuned to radio/TV, follow weather.gov and be ready to seek higher ground.
Learn more at weather.gov/flood.
be prepared.
NOAA
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE

What causes flooding to take place?

- Several factors affect how easily water comes in and moves out with common regions of common characteristics grouped into basins

- When flooding occurs, the input into the river is greater than water flowing out
  - This can be gradual (flooding)
  - Or this can be rapid (flash flooding)



The Role of Urbanization/Man-Made Development

- Winding/curved paths forces water to take longer to cover similar distances

- Roadways create channels for water to follow that are straight and impermeable

- Typical VT urban flooding occurs in Burlington, Rutland and Barre, VT

    - These areas require less rainfall over a given period of time to cause flooding

Flooding in Burlington, VT- July 4, 2012

Research article on Improving detection of Flash Flooding in VT: https://bit.ly/2SA2jvQ

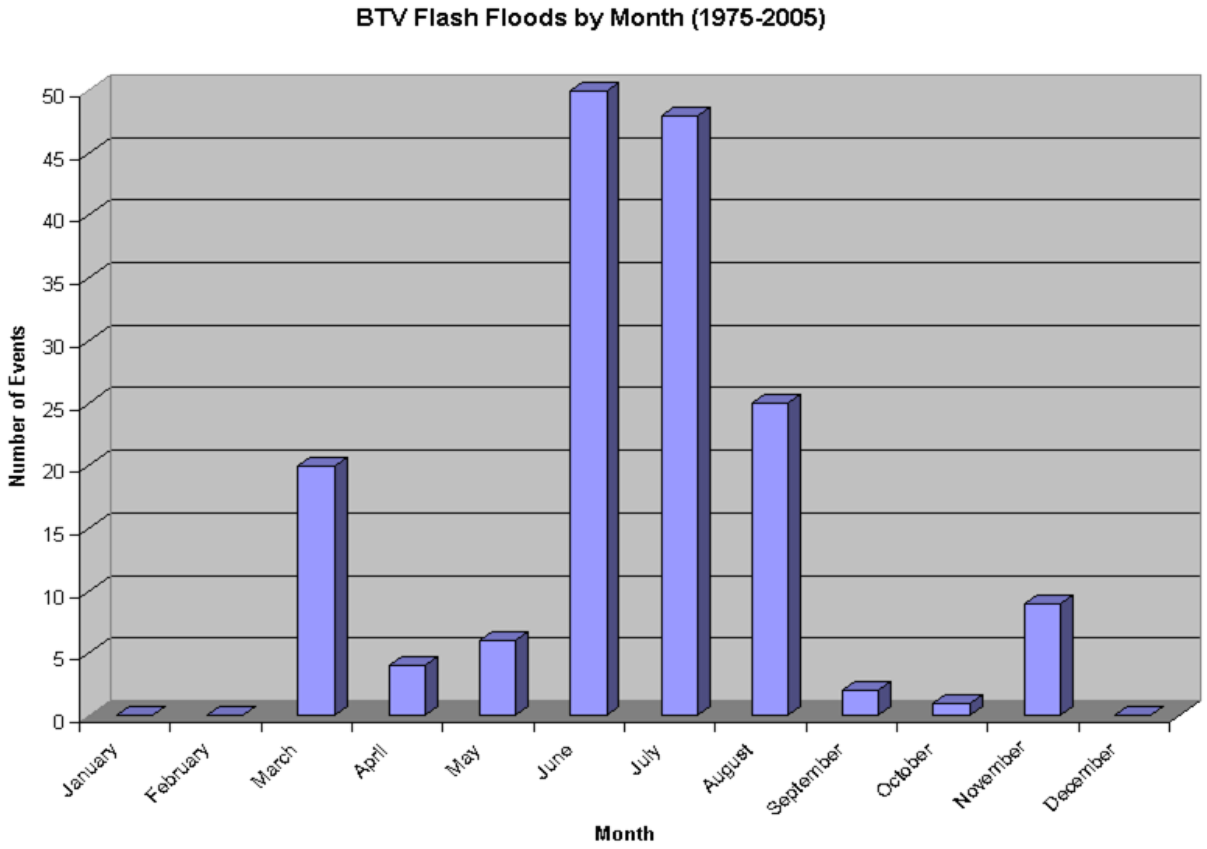
Flood vs Flash Flood

The key difference is do waters rise quickly (***FLASH FLOOD***) or do waters rise gradually (***FLOOD***)?

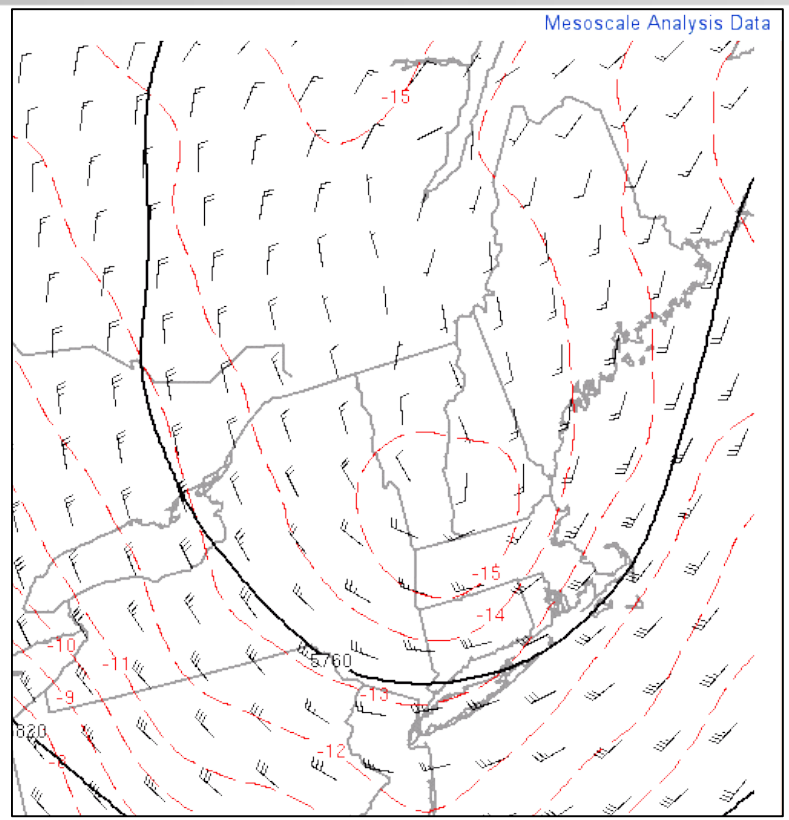
- ***Flash Floods*** are most often caused from excessive rain in a short window of time
- ***Flash Floods*** can readily transition into areal or river floods if water remains in place
- ***Floods*** arise from many gradual contributions to river rises.

When is Flooding Common in the North Country

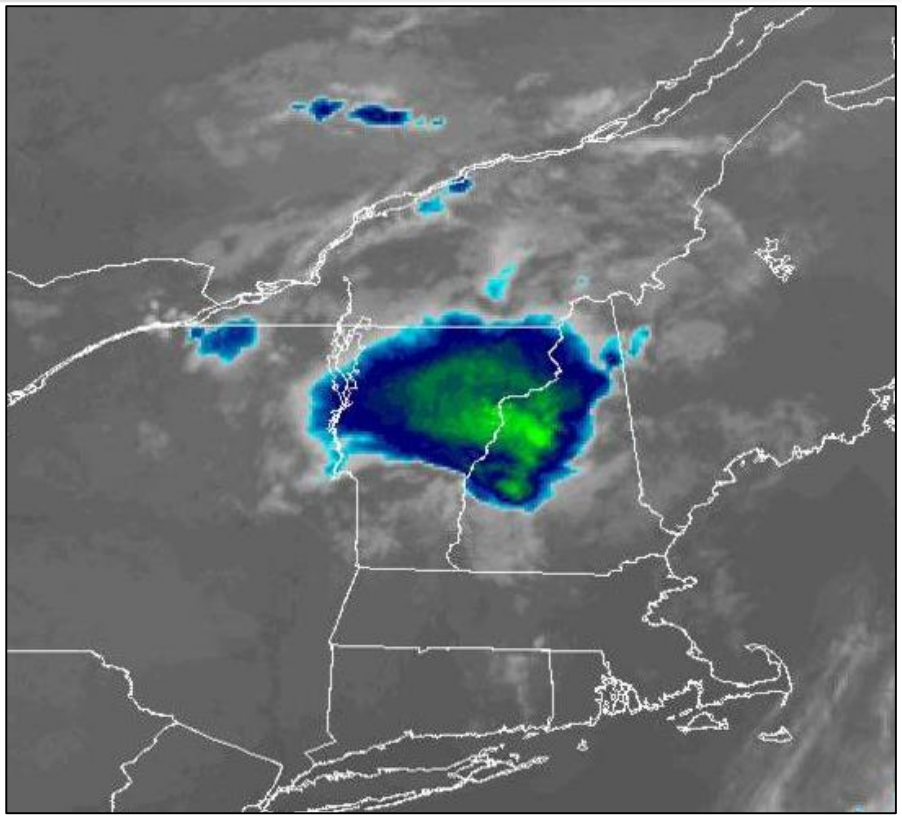
- Spring snowmelt saturates soils and produces run-off into rivers and tributaries
  - Causes river levels to rise which may produce ice jams on ice covered rivers
    - Water has difficulty efficiently moving due to jam
- In fall, vegetation goes into dormancy and vegetation collects less water
  - Leads to greater runoff
- Atmospheric pattern can produce strong, moisture laden storms
  - September and October, non-tropical cyclones (October 2017 storm/1927 Flood) or recurving tropical cyclones (Floyd/Irene)
- During the summer, training thunderstorms - tends to be more localized



Ingredients for Heavy Rainfall



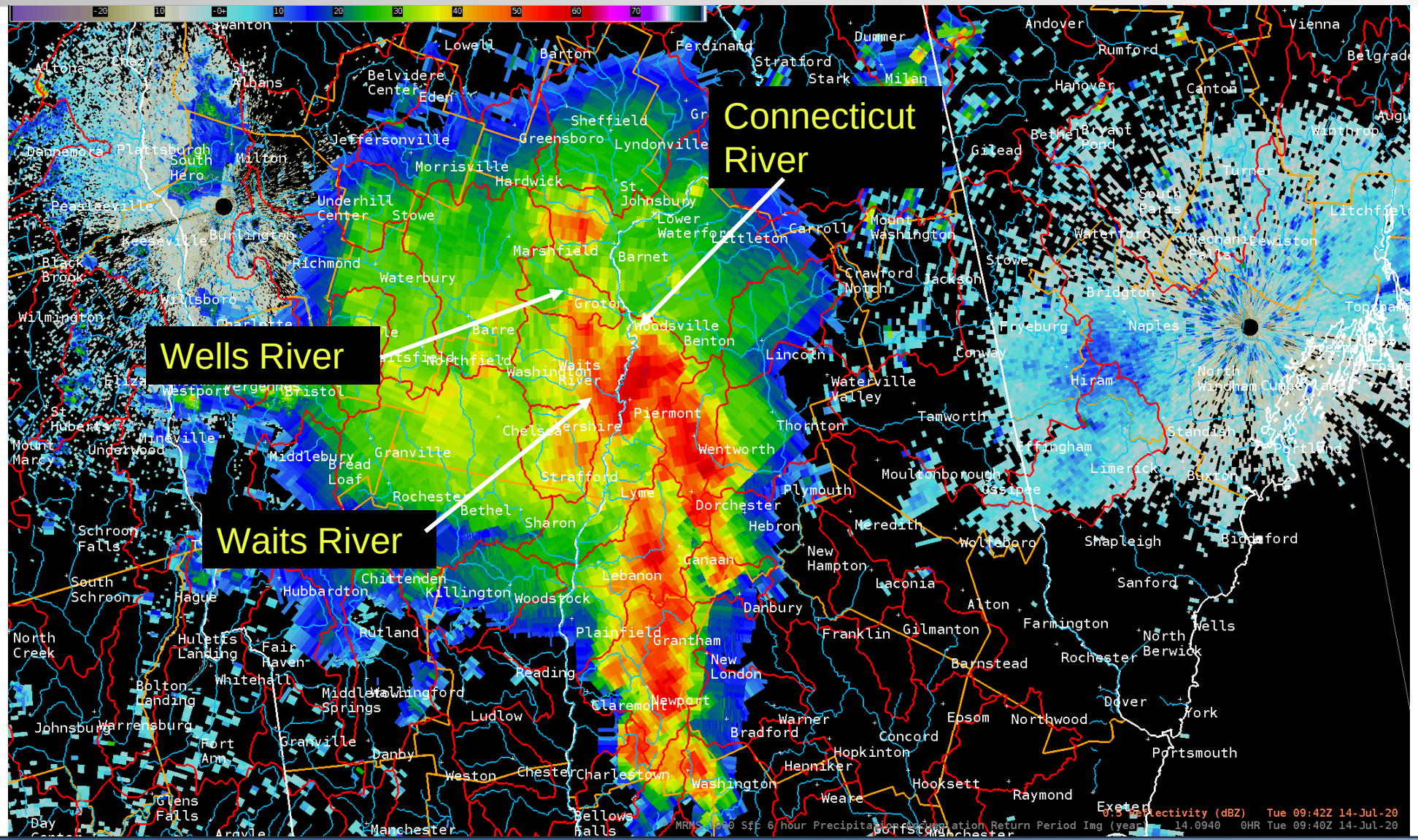
500 mb map – Often involves an upper low



Thunderstorms over eastern Vermont

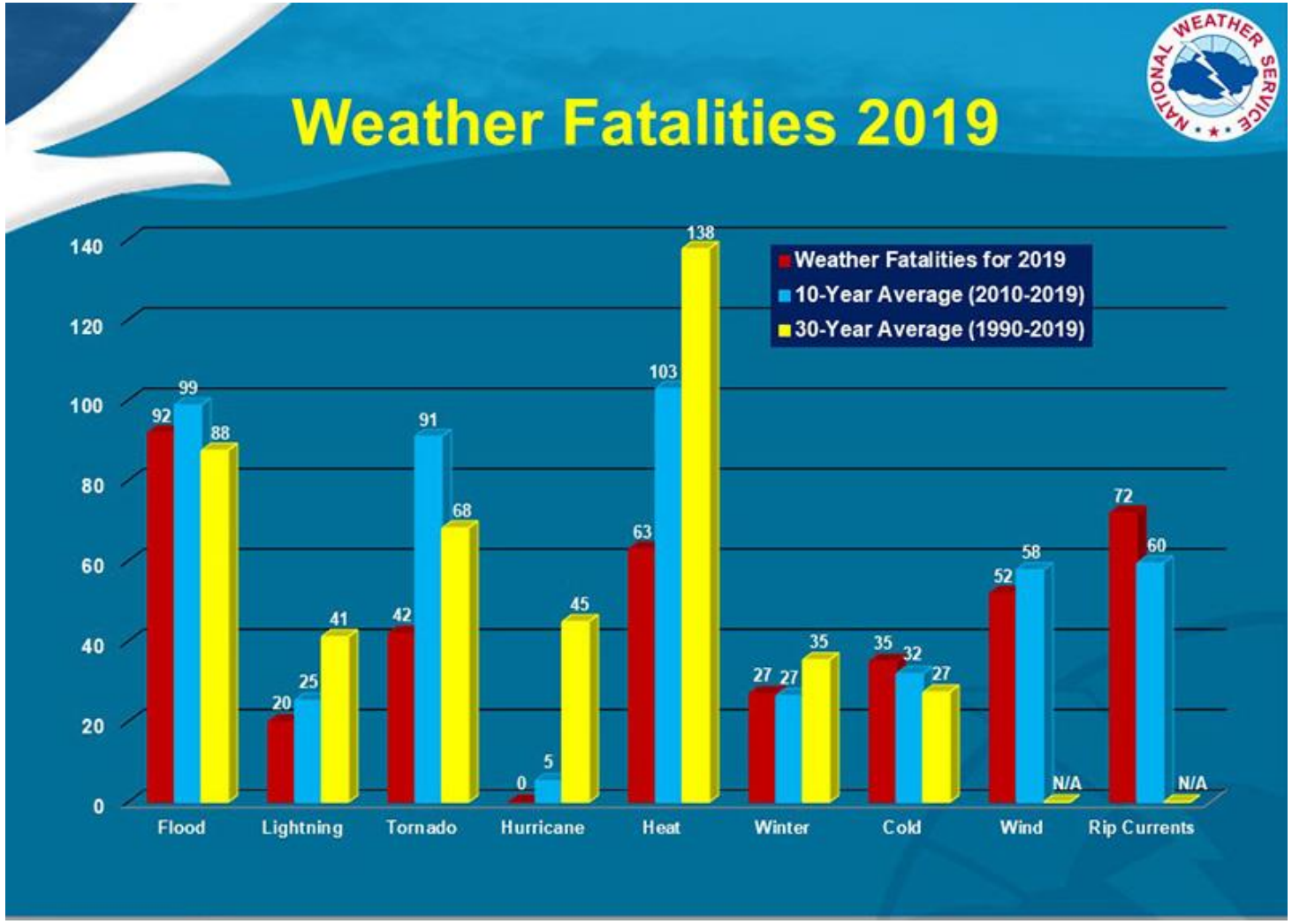
- **Slow moving system** result in prolonged rainfall over the same area.
- **High moisture content** of the atmosphere – favorable for heavy rain.
- Enough instability to support some embedded **thunderstorms**

Radar Loop on July 14th, 2020



Safety Message!

- The force of flooding is often underestimated
- Across 2019 it was number 1 and across multi-year averages, it has been the number 2 cause of weather related fatalities



Safety Message!

- In the event waters are rising, seek higher ground
- Sometimes, that may mean you have to leave your interior structure
- Stay calm and use good judgment in these scenarios

April 16, 2019 Flooding
Killington, VT

Mar 11, 1992 Ice Jam Flooding
Montpelier, VT

Safety Message!

- Don’t underestimate the power of running water
- You may not be able to see whether the road is in tact beneath flood waters
- Nearly two-thirds of flood-related deaths are from driving into floodwaters
- Turn around, don’t drown

Any Questions?

Forecasting Winds for Lake Champlain

- Marine forecasting → It's all about mixing potential

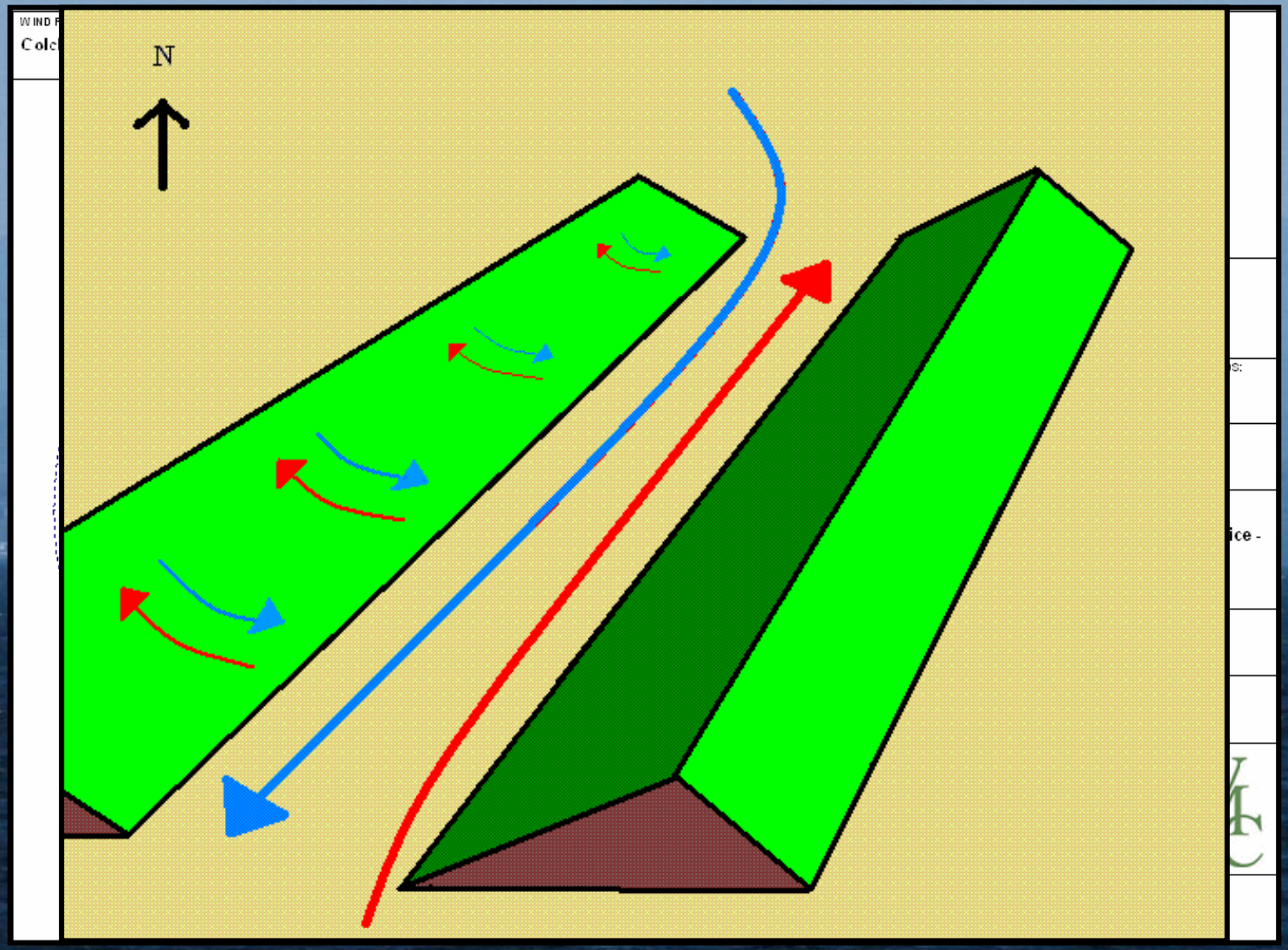
1. Less friction over water → winds greater
2. Is water temperature warmer or colder than air?
   A. Water/air temperature profile governs mixing
   B. Cool air atop warm air → more unstable
3. Channeled flow → Winds accelerate through the Champlain Valley (Bernoulli Principle)

Forecasting Winds for Lake Champlain

Seasonal Temperature and Stability Profiles Near Large Bodies of Water			
Season	**Relative Sea Surface Temperature**	**Relative Air Temperature**	**Boundary Layer Stability**
Winter	**Cool**	**Cold**	**Unstable (Strong Winds)**
Spring	**Cold**	**Cool**	**Stable (Weak Winds)**
Summer	**Cool**	**Warm**	**Stable (Weak Winds)**
Fall	**Warm**	**Cool**	**Unstable (Strong Winds)**

Forecasting Winds for Lake Champlain

- Channeled flow
  - Winds tend to blow north/south due to valley topography
  - Winds become channeled and stronger in the valley than surrounding areas



Reporting Severe Weather

- An effective spotter report answers the following questions:
  - Where are you located?
  - Where was the severe weather?
  - What time was the severe weather?
  - How long did it last?
  - Who are you?

Heavy Rainfall: 1” an hour or greater or any flooding

Reporting Methods

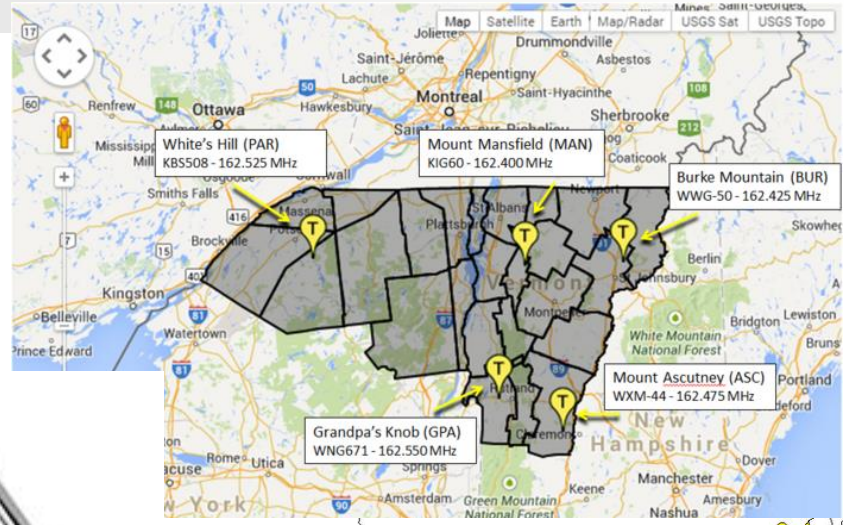
- Be as specific as possible! We may not be as familiar with your roads/cities.
- Reference nearby intersections, landmarks, or even your latitude/longitude to help us pinpoint where active weather is occurring.

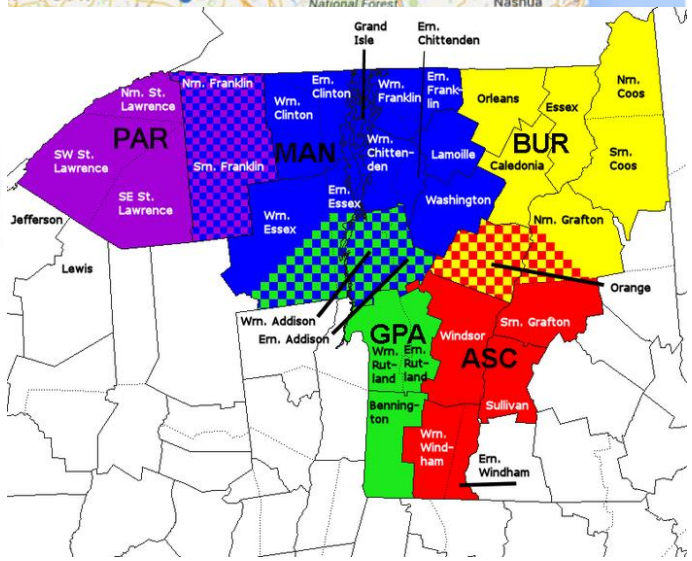
Reporting Methods

- By Phone (1-800-863-4279) - unlisted
- By Social Media (FB/Twitter)
- By Amateur Radio (WX1BTV - 144.510 MHz)
- By our storm report page (https://www.weather.gov/btv/stormreport)
- By mPING (https://mping.ou.edu/static/mping/access.html) - access via iPhone or Google Store - and select your weather observation.
- Share with us your photos!

How to get alerts

- NOAA Weather Radio
- Alerts through your phone (WEA)
- TV Broadcasts/Media Outlets





How to get alerts

- NOAA Weather Radio
- Alerts through your phone (WEA)
- TV Broadcasts/Media Outlets

LOCAL abc 22 WVNY

5 WPTZ

WCAX 3

10 BOSTON

Local news stations help broadcast NWS watches and warnings!

Any lingering questions before we wrap up?

What to report?

- A TORNADO, Waterspout or Funnel Cloud
- Dangerous or Severe Thunderstorms (strong damaging winds, very heavy rain or large hail)
- Any Damaging Winds…(large tree limbs down or any structural damage)
- Lightning damage
- Hail…specify the size, location, and time of occurrence
- Heavy Rain…especially an inch or more in a short time (2 hours or less)
- Actual FLOODING of any river or stream, due to heavy rain or ICE JAMS
- Heavy snow…ongoing significant amounts and the total new snow after the storm is over
- Ice storm or freezing rain…especially if un-forecasted or damage is occurring

Summary

- A reliable Skywarn Spotter provides ground truth and potentially life-saving information (downed trees or lines/funnel clouds/heavy rain/wind damage)
- Storms come in various flavors. The more organized, the more likely severe impacts will occur
  - Wall clouds, shelf clouds, overshooting tops
  - Lines or bow echoes on radar
- Severe weather in the North Country is most common in June, July, and August.
- Your safety should come first. Never put yourself in harms way to provide us info.
- Be as specific as possible! We may not be as familiar with your roads/cities. Referencing nearby intersections, landmarks, or even your latitude/longitude will help us pinpoint where active weather is occurring.

Review Questions

1. Which ingredients are favorable for thunderstorms?

- **Warm, moist air (makes for convection, like in an oven)**
- **Air masses moving towards each other (on the ground, nowhere to go but up!)**
- **Unstable atmospheric conditions (Storms need to grow taller, requires instability)**

Review Questions

2. What distinguishes a supercell from the average thunderstorm

- **The key is that they are rotating**
- **While supercells are associated with tornadoes, only ~20 percent of supercells produce tornadoes.**

Review Questions

3. The National Weather Service is the only entity that issues official watches and warnings for the United States

- **This statement is true!**
- **We are a part of the Department of Commerce, and our warning products are intended to protect life, property, and enhance the national economy.**

Review Questions

4. When the ingredients for tornadic weather are expected to come together for several hours, what does the NWS issue?

- **A tornado watch!**
- **When the ingredients are in place and tornadic storms are possible, this is issued**
- **When the ingredients come together and the tornadic storm is occurring, a warning is issued**

Review Questions

5. As storms develop and radar indicates strong, concentrated rotation, what does the NWS issue?

- **A tornado warning!**
- **However, we may also elect to issue a severe thunderstorm warning with a tornado possible tag. This suggest a greater degree of uncertainty on our part. This is when a storm is giving us mixed signals (or if we're looking at a storm far away from the radar).**

Review Questions

6. Which month climatologically sees the most active weather in the North Country?

- **July is often our busiest month**

Review Questions

7. Where's the safest place to be in a thunderstorm?

- **Inside of a building, away from windows, and in a central room.**
- **Not under a tree – they can be struck, splintering the tree.**

Review Questions

8. What makes a “flash flood” a flash flood?

- **Water is flowing where water shouldn’t be**
- **Sharp, sudden rises in waterways also counts**

Review Questions

9. How much moving water does it take to sweep away an adult?

- **As little as 6 inches is enough to sweep away an adult.**

Review Questions

10. When you report weather, what information should you include?

- **What happened (hail, damaging wind, tornado, flooding)**
- **When did it happen (helps us match to radar!)**
- **Where did it happen (be as specific as possible!)**
- **Who you are and what's your name (helps us double-check the Spotter network. We have many spotters, and we don't know all of you by name)**
- **How long it lasted (May be most important with hail and snow)**

Thanks for your attendance!

Robert Haynes – robert.d.haynes@noaa.gov

If you are interested in becoming a Spotter – email me or call our office to inform us that you have completed the course. You will be given our unlisted Spotter Number.

Please provide a: Name, Address (or lat/lon), Phone Number

Web:
http://www.weather.gov/btv/stormreport

Toll-Free Spotter Line
1-800-863-4279

E-mail:
nws.er.btv.operations@noaa.gov

Facebook:
https://www.facebook.com/NWSBurlington

Twitter:
https://twitter.com/NWSBurlington

YouTube:
https://www.youtube.com/NWSBurlington